

Atlantic Richfield Company

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June 4, 2015

Mr. Steven Way
On-Scene Coordinator
Emergency Response Program (8EPR-SA)
US EPA Region 8
1595 Wynkoop Street
Denver, CO 80202-1129

Delivered via e-mail

Subject: May 2015 Monthly Progress Report
Rico-Argentine Mine Site – Rico Tunnels
Operable Unit OU01, Rico, Colorado

Dear Mr. Way,

This progress report describes activities conducted during the month of May, 2015 at the Rico-Argentine Mine Site (site) and activities anticipated to occur during the upcoming month. These activities are organized by task as identified in the Removal Action Work Plan. This progress report is being submitted in accordance with Paragraph 35.a of the Unilateral Administrative Order for Removal Action (the “UAO”), dated March 17, 2011 (effective March 23, 2011).

ACTIVITIES FOR MAY

This section describes significant developments during the preceding period including actions performed and any problems encountered during this reporting period. A summary of the St. Louis Tunnel Discharge Constructed Wetland Demonstration (Wetland Demonstration) Treatability Study system performance is provided as an attachment.

Site-Wide Activities

- Monitored site for any major security concerns and system functionality.
- Continued work with the US Forest Service in support of the Small Tracts Act (STA) acquisition parcels in the North St. Louis Ponds area. Completed the right-of-way (ROW) survey of the San Miguel Electric power line through the STA 1 parcel.
- Continued to coordinate with the Rico Town Manager regarding the Town’s water pipeline replacement project progress and plans for soil removal, sampling and disposal at the Soil Lead Repository.
- Continued borrow soil investigation study by surveying, excavating test pits, and sampling potential local borrow sources.

Task A – Pre-Design and Ongoing Site Monitoring

- Performed additional evaluation of potential improvements to surface water flow data gathering and telemetry.
- Collected data from pressure transducers at DR-3, DR-6, and AT-2. Collected manual flow measurements from DR-3 and DR-6.
- Inspected the St. Louis Ponds System, pond water levels, free-board, and condition of outlet pipes and overflow spillways. The pond network appears to be flowing well and in good condition.

- Surveyed water levels of all active ponds.
- Began the 2015 Rico peak flow periodic groundwater and surface water monitoring work:
 - Collected water samples, field water quality parameters, and water level measurements from the following groundwater wells: GW-1, GW-3, GW-4, GW-6, EB-1, EB-2, MW-1 DEEP, MW-1 SHALLOW, MW-2 DEEP, MW-3 DEEP, MW-4 DEEP, MW-4 SHALLOW, MW-5 DEEP, MW-5 SHALLOW, MW-6 DEEP, MW-6 SHALLOW, MW-103, MW-104, MW-105, MW-106, MW-107, MW-108D, MW-108S, MW-109S, MW-110, MW-208, P13-102, P13-103, PZ-1, and PZ-2, as well as angle boreholes AT-2 and BAH-01.
 - Collected groundwater elevations only from wells MW-2 SHALLOW, MW-3 SHALLOW, and MW-202 as there was insufficient water depth to collect samples.
 - Collected six blind duplicate samples, six field blanks, and three matrix spike / matrix spike duplicate samples per the quality control (QC) requirements of the project Quality Assurance Project Plan (QAPP).
 - Calibrated and serviced data loggers and transducers.

Task B – Management of Precipitation Solids in the Upper Settling Ponds

- Diverted the majority of St. Louis Adit discharge to Pond 15. A slip stream flow continues to be diverted to the Wetland Demonstration vertical and horizontal treatment trains.
- Continued planning for removal of remaining mining/mineral processing by-products from Upper Ponds.
- Began solids removal from Pond 18 to Pond 13 as discussed in more detail under Task F.

Task C – Design and Construction of a Solids Repository

- Continued grading of starter dike and excavation of repository. Completed raise of starter dike to elevation 8850 as of June 1, 2015.
- Continued QC and quality assurance (QA) testing of the Solids Repository starter dike.
- Identified and removed a debris pile located in the back slope of the Solids Repository and backfilled with embankment fill.
- Submitted final design drawings and scope of work for Interim Drying Facility (IDF) Reconfiguration and Pond 13 Upgrades to AR for construction.
- Began work on reconfigured IDF and improvements to Pond 13 for use in interim management of solids to be removed in 2015. Completed initial Pond 13 improvements.
- Continued work for interim management of mining/mineral processing by-products. Existing oxy-hydroxide solids in the IDF were consolidated to Cell 4 to be disposed of in the Phase 1 Solids Repository later this construction season. Calcines and calcines-impacted soils from construction of Wetland Demonstration and other grading on site were consolidated to a stockpile in the north laydown area and will continue to be managed for the interim in one or more separate stockpiles on site.

Task D – Hydraulic Control Measures for the Collapsed Area of St. Louis Tunnel Adit

- Continued work on the design and specifications for the St. Louis Tunnel hydraulic controls system.
- Site walk and meeting with EPA on May 28, 2015 to discuss the St. Louis Tunnel hydraulic controls system. As a result of that meeting, submitted a letter to EPA on May 29, 2015 to request a revision to the due date for the Stage 2 Final Design and the Stage 2 Construction Start.
- Monitored water levels in the tunnel at AT-2 using the data logger.
- Downloaded flow measurement data from pressure transducer at AT-2.



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Task E – Source Water Investigations and Controls

- Continued Blaine Tunnel water depth and flow monitoring behind the Blaine Cofferdam at the Blaine Tunnel Flume.
- EPA and Colorado Division of Reclamation, Mining and Safety (DRMS) representatives entered the Argentine and Blaine tunnels on May 28, 2015 to observe water flow conditions. A water sample was collected at the Argentine tunnel pool for metals and solute analysis.

Task F – Water Treatment System Analysis and Design

- Completed two sampling events during the month of May 2015 at the Wetland Demonstration during the weeks of May 4 – 8 and May 18 – 22. The sampling events included the following activities:
 - Collected water samples, water quality parameters, and water level elevations at all 11 sampling and monitoring locations. Collected additional water quality parameters at 14 monitoring locations.
 - Conducted a hydrogen sulfide survey throughout the Wetland Demonstration area.
 - Serviced, calibrated, and maintained hydrogen sulfide meters near the rock drain and the Horizontal Sub-Surface Flow (HSSF) Wetland.
 - Recorded flowrate measurements from flow monitoring locations within the Wetland Demonstration.
 - Serviced, calibrated, and maintained 9 water quality sondes from throughout the Wetland Demonstration.
 - Downloaded data from thermocouples in the rock drain and the HSSF Wetland.
- The Enhanced Wetland Demonstration (EWD) kick-off meeting was held the week of May 4th.
- Completed hydrogen sulfide (H₂S) monitoring throughout the month and serviced H₂S monitors.
- Continued flow of St. Louis Adit discharge to Pond 15 to facilitate Pond 18 solids removal for EWD construction.
- Collected field data to confirm telemetry readings in the vertical and horizontal wetland treatment trains.
- Maintenance and process adjustments conducted on the Wetland Demonstration for performance improvement.
- Dewatered Pond 18 and prepared Pond 13 access for interim solids placement. Began hauling solids from Pond 18 to Pond 13 on May 27, 2015 for interim management prior to placement in the Solids Repository.
- Began backfilling excavated areas of Pond 18 with bridging material excavated from the Solids Repository footprint.
- Began procurement of equipment and materials for construction of the EWD.
- Initiated grading and construction of the Pond 15 bypass channel to facilitate EWD construction.

ACTIVITIES FOR UPCOMING MONTH

This section describes developments expected to occur during the upcoming reporting period, including a schedule of work to be performed, anticipated problems, and planned resolution of past or anticipated problems.

Site-Wide Activities

- Perform ongoing security observation of the site.
- Continue water flow management for St. Louis Tunnel discharge to accommodate new construction.
- Continue borrow soil investigation.
- Coordinate with Town of Rico to sample and receive mining impacted soils from pipeline installation excavation.



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Task A – Pre-Design and Ongoing Site Monitoring

- Inspect the St. Louis Ponds System, water levels, and free-board.
- Continue work on submittal and processing of the application for a telemetry antenna permit for the Rico office building.
- Download data from pressure transducers at DR-3, DR-6, and AT-2.
- Complete the 2015 Rico peak flow periodic surface water sampling event by collecting surface water samples at DR-1, DR-2, DR-3, DR-4, DR-5, DR-6, DR-7, DR-4-SW, and DR-G.
- Collect flow measurements from DR-2, DR-3, DR-4, DR-5, DR-6, and DR-7.
- Survey water levels of all active ponds.

Task B – Management of Precipitation Solids in the Upper Settling Ponds

- Continue routing St. Louis Tunnel discharge to Pond 15.
- Continue planning for removal of all remaining mining/mineral processing by-products from Upper Ponds.
- Continue removal of precipitated solids from Pond 18.

Task C – Design and Construction of a Solids Repository

- Complete repository subgrade excavation and construction of starter dike.
- Begin installation of repository liner system (including cushion layer, anchor trench, HDPE geomembrane, and leachate collection system piping).
- Complete IDF reconfiguration.
- Continue work for interim management of mining/mineral processing by-products.

Task D – Hydraulic Control Measures for the Collapsed Area of St. Louis Tunnel Adit

- Submit the Stage 2 100% Drawings and Final Specifications for the St. Louis Tunnel hydraulic controls system to EPA.
- Monitor water levels in the St. Louis Tunnel at AT-2.
- Conduct additional survey of existing features at historic portal and lime plant building/silo location to support construction-period diversion system design.

Task E – Source Water Investigations and Controls

- Continue Blaine Tunnel water depth and flow monitoring behind the Blaine Cofferdam at the Blaine Tunnel Flume.
- Download Blaine data logger.

Task F – Water Treatment System Analysis and Design

- Continue scoping additional data needs as necessary related to treatment system alternatives.
- Perform sampling of the Wetland Demonstration twice per month.
- Continue dewatering Pond 18, Pond 18 solids removal, and placement of solids in Pond 13.
- Continue backfilling excavated areas of Pond 18 with bridging material excavated from the Solids Repository footprint.
- Continue procurement of EWD equipment and materials.
- Initiate construction of the EWD.



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If you have any questions, please feel free to contact me at (951) 265-4277.

Sincerely,



Anthony R. Brown
Project Manager
Atlantic Richfield Company

cc: R. Halsey, Atlantic Richfield
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file: Atlantic Richfield Rico Archives, La Palma, CA
AECOM Denver Project File



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Attachment

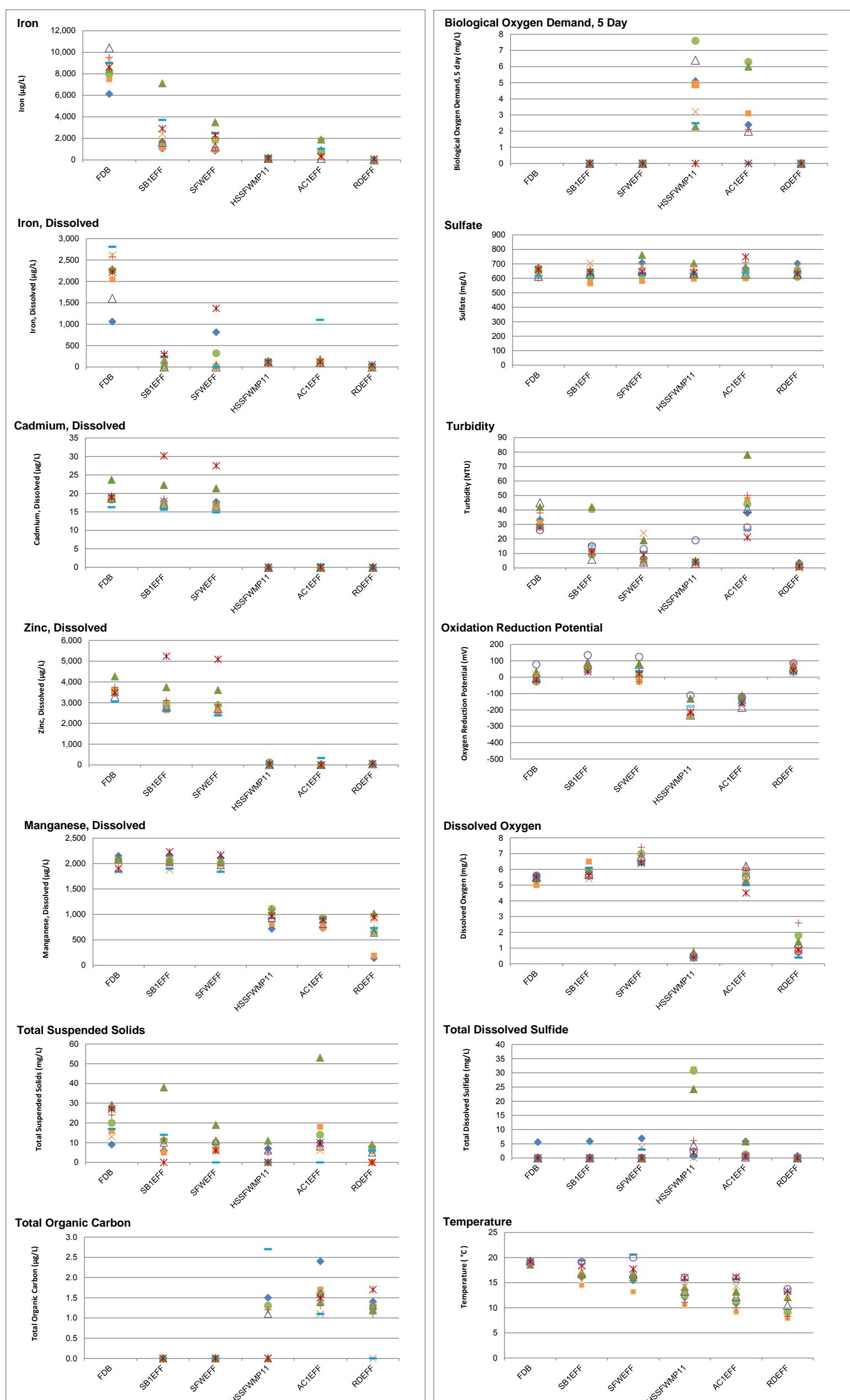


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Key Performance Indicators Figures

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01



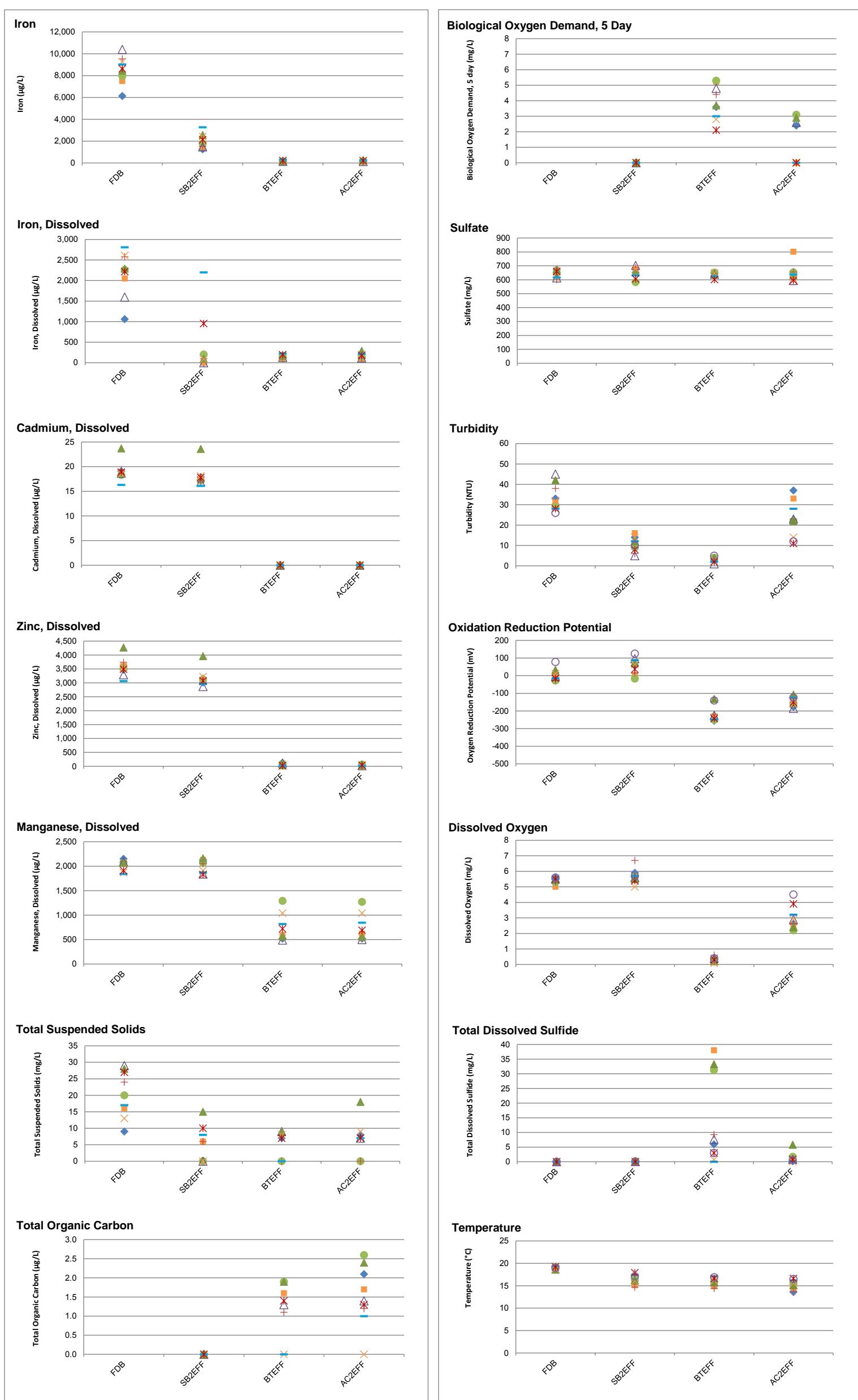
Non-detects are reported as less than the laboratory Reporting Limit (RL) and estimated as zero for calculations and graphing (Colorado Department of Public Health and Environment Water Quality Control Commission 5 CCR 1002-34).

Values presented for physical and chemical parameters are from field measurements obtained during sampling events.

AC1EFF = Aeration Channel Effluent/Rock Drain Influent
 CWDTS = Constructed Wetland Demonstration Treatability Study
 FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)
 HWTT = Horizontal Wetland Treatment Train
 KPI = Key Performance Indicators
 RDEFF = Rock Drain Effluent
 HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent
 SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent
 SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent
 °C = Degrees Celsius
 µg/L = micrograms per liter
 mg/L = milligrams per liter
 mV = millivolts
 NTU = Nephelometric Turbidity Units
 RL = Reporting Limit

TR01 W00, 22.7 gpm TR01 W02, 20.4 gpm TR01 W04, 27.0 gpm TR01 W06, 28.6 gpm
 TR01 W09, 29.3 gpm TR01 W11, 34.9 gpm TR02 W00, 32.3 gpm TR02 W02, 36.7 gpm
 TR02 W04, 35.2 gpm TR02 W06, 32.0 gpm

FIGURE 1
HWTT KPI Spatial Series Testing Phase
 St. Louis Tunnel Discharge CWDTS
 Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

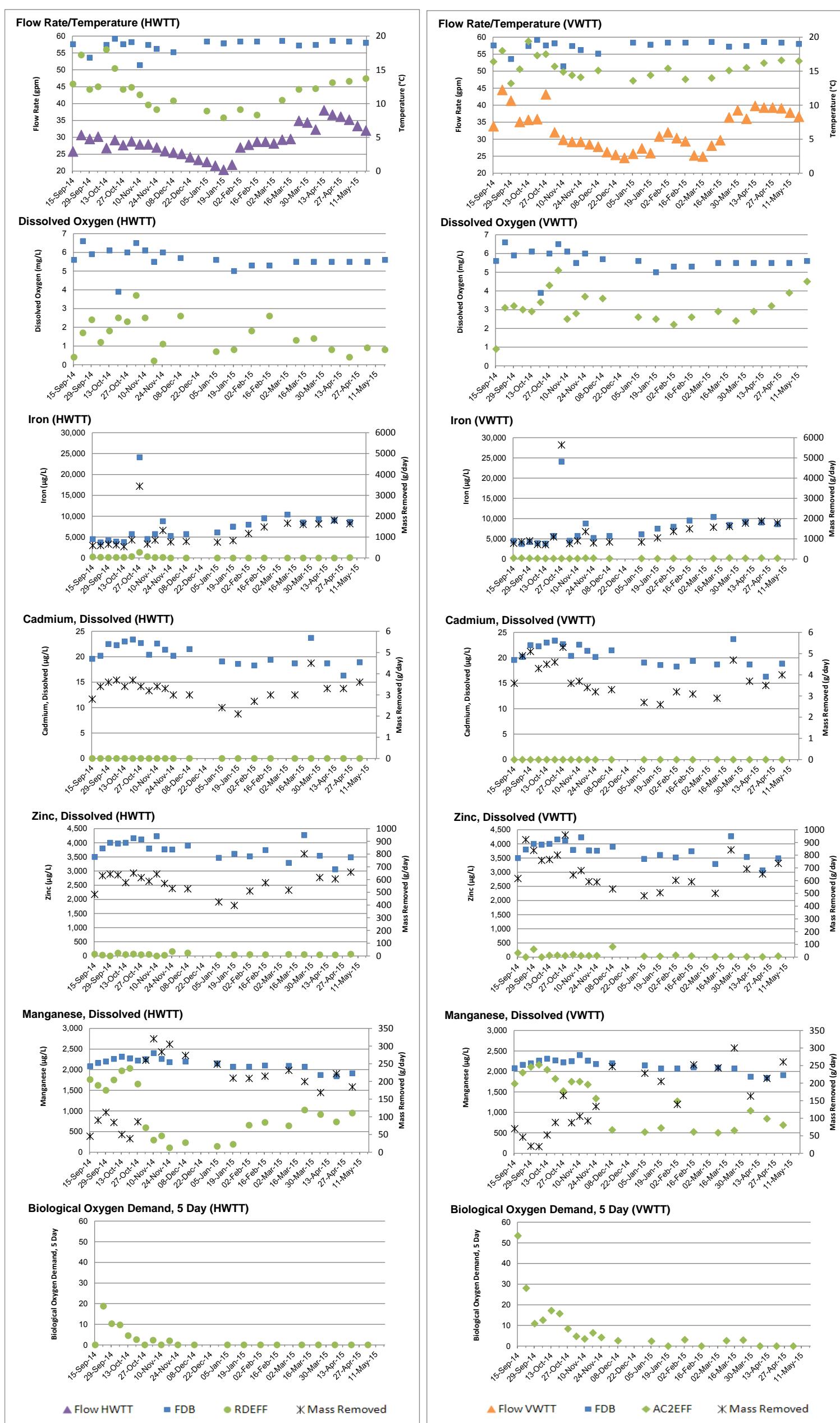


Non-detects are reported as less than the laboratory RL and estimated as zero for calculations and graphing (Colorado Department of Public Health and Environment Water Quality Control Commission 5 CCR 1002-34). Values presented for physical and chemical parameters are from field measurements obtained during sampling events.

AC2EFF = Aeration Cascade Effluent
 BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent
 CWDTS = Constructed Wetland Demonstration Treatability Study
 FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)
 KPI = Key Performance Indicators
 SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent
 VWTT = Vertical Wetland Treatment Train
 °C = Degrees Celsius
 µg/L = micrograms per liter
 mg/L = milligrams per liter
 mV = millivolts
 NTU = Nephelometric Turbidity Units
 RL = Reporting Limit

◆ TR01 W00, 25.7 gpm ■ TR01 W02, 25.9 gpm ● TR01 W04, 32.0 gpm + TR01 W06, 29.3 gpm
 △ TR01 W09, 28.1 gpm ▲ TR01 W11, 36.4 gpm × TR02 W00, 36.0 gpm - TR02 W02, 39.3 gpm
 ✕ TR02 W04, 39.1 gpm ○ TR02 W06, 36.6 gpm

FIGURE 2
VWTT KPI Spatial Series Testing Phase
 St. Louis Tunnel Discharge CWDTS
 Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01



Non-detects are reported as less than the laboratory RL and estimated as zero for calculations and graphing (Colorado Department of Public Health and Environment Water Quality Control Commission 5 CCR 1002-34).

Values presented for physical and chemical parameters are from field measurements obtained during sampling events.

The Aeration Cascade in the VWTT train was bypassed on different occasions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

AC2EFF = Aeration Cascade Effluent

CWDTS = Constructed Wetland Demonstration Treatability Study

FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)

HWTT = Horizontal Wetland Treatment Train

RDEFF = Rock Drain Effluent

VWTT = Vertical Wetland Treatment Train

°C = Degrees Celsius

gpm = gallons per minute

µg/L = micrograms per liter

mg/L = milligrams per liter

mv = millivolts

NTU = Nephelometric Turbidity Units

RL = Reporting Limit

FIGURE 3

HWTT/VWTT Key Performance Indicators Time Series

St. Louis Tunnel Discharge CWDTS

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

DRAWN BY: LPCjr
 CHECKED: LPCjr
 REVIEWED: KS
 APPROVED: KS
 JOB No: 1300
 CAD FILE: Figure 4.dwg

DESCRIPTION

REV DATE

RESOURCE MANAGEMENT CONSULTANTS
 SUITE 2A
 MIDVALE, UT 84047
 801-255-2626



RICO - ARGENTINE MINE SITE
 ST LOUIS DISCHARGE CWDTS

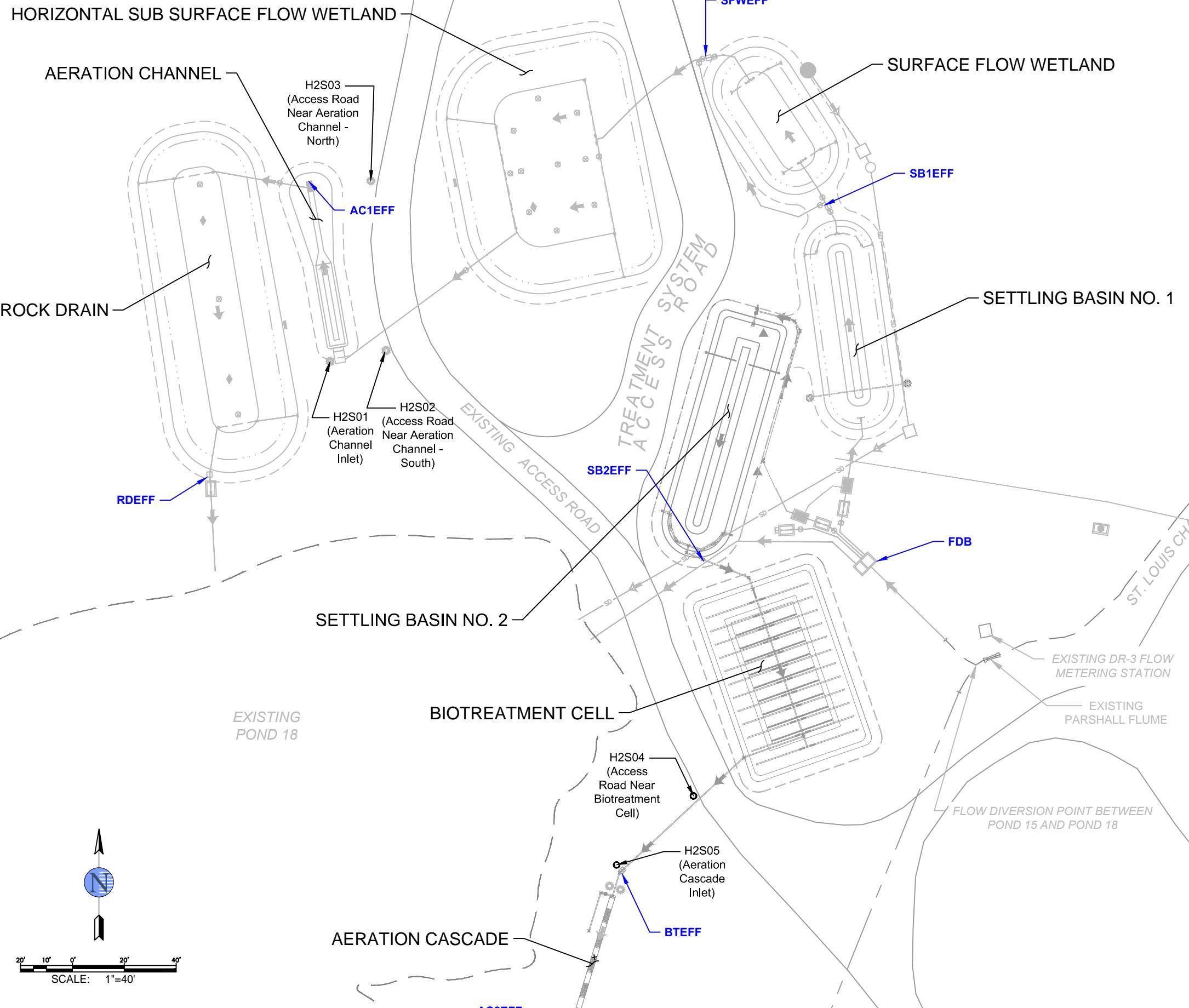
Monthly Progress Report
 Monitoring Locations

AEEC

www.americanconsultants.com
 3489 W 2100 S, Salt Lake City, UT 84119
 801-908-5447 Fax 801-972-2741

DATE: 01 DEC 14
 SCALE: 1:40
 SHEET: 01 OF 01

Figure 4



20' 10' 0' 20' 40'

SCALE: 1"=40'

Key Performance Indicators Tables

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Table 1. Iron ($\mu\text{g/L}$)

Horizontal and Vertical Wetland Treatment Trains

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H ¹ (gpm)	FLOW V ^{1,2} (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	4500	1330	1200	223	261	250	1250	266	246
C	W01	22-Sep-14	30.7	44.5	3740	1070	930	168	203	170	971	206	218
C	W02	29-Sep-14	29.5	41.3	4230	1640	1360	194	250	129	1440	216	210
C	W03	06-Oct-14	30.2	35.1	3940	1720	1540	142	156	134	937	171	165
C	W04	13-Oct-14	26.8	35.7	3820	892	900	146	138	144	1500	161	154
C	W05	20-Oct-14	29.2	35.9	5730	1260	1010	133	1010	326	1390	244	143
C	W06	27-Oct-14	27.7	43.2	24100	1630	1330	171	304	1340	R	157	137
C	W07	03-Nov-14	28.8	32.0	4550	1180	1130	126	118	297	902	175	153
C	W08	10-Nov-14	27.9	29.8	5720	1540	1380	137	115	99.6	1640	151	148
C	W09	17-Nov-14	27.9	29.2	8800	978	1190	218	2140	141	1670	253	260
C	W10	24-Nov-14	27.0	29.2	5230	1550	1270	135	712	<50	1850	236	245
C	W11	01-Dec-14	25.9	28.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	25.5	27.8	5710	1490	1280	129	538	<50	1320	164	156
C	W13	15-Dec-14	25.1	26.2	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	24.1	25.4	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	23.3	24.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	22.7	25.7	6130	1060	867	129	905	<50	1260	151	131
TR01	W01	12-Jan-15	21.6	27.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	20.4	25.9	7510	1110	920	117	1830	<50	1460	116	109
TR01	W03	26-Jan-15	21.9	30.8	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	27	32	7980	1600	1870	150	688	<50	1780	164	162
TR01	W05	09-Feb-15	27.8	30.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W06	16-Feb-15	28.7	29.4	9530	1710	1190	136	1910	<50	1520	143	142
TR01	W07	23-Feb-15	28.7	25.2	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W08	02-Mar-15	28.2	24.9	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W09	09-Mar-15	29.3	28.1	10400	1620	1210	146	140	<50	1480	148	138
TR01	W10	16-Mar-15	29.5	29.7	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W11	23-Mar-15	34.9	36.4	8450	7120	3500	147	1890	<50	2560	178	291
TR01	W12	30-Mar-15	34.4	38.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W00	06-Apr-15	32.3	36	9260	2420	1880	153	164	<50	2420	205	202
TR02	W01	13-Apr-15	38	39.8	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W02	20-Apr-15	36.7	39.3	9020	3720	2480	300	1030	<50	3270	309	261
TR02	W03	27-Apr-15	36.1	39.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W04	04-May-15	35.2	39.1	8630	2900	2300	166	327	75.8	2130	218	210
TR02	W05	11-May-15	33.4	37.8	NS	NS	NS	NS	NS	NS	NS	NS	NS

NOTES:

Non-detects are reported as less than the laboratory Reporting Limit (RL) and estimated as zero for calculations and graphing (Colorado Department of Public Health and Environment Water Quality Control Commission 5 CCR 1002-34).

AC1EFF = Aeration Channel Effluent/Rock Drain Influent

AC2EFF = Aeration Cascade Effluent

BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent

C = Colonization

FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)

Flow H = horizontal treatment train average flow rate

Flow V = vertical treatment train average flow rate

gpm = gallons per minute

HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent

NS = not sampled

OU = operable unit

RDEFF = Rock Drain Effluent

R = rejected

RL = reporting limit

SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent

SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent

SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent

TR** = Testing Phase Test Run

 $\mu\text{g/L}$ = microgram per liter

VWTT = Vertical Wetland Treatment Train

W** = Week of Treatability Study Phase

¹ The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.² The Aeration Cascade in the VWTT was bypassed on different occasions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 2. Iron, Dissolved (µg/L)

Horizontal and Vertical Wetland Treatment Trains

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H ¹ (gpm)	FLOW V ^{1,2} (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	772	56.4	<50	80.7	50.8	76.2	101	213	174
C	W01	22-Sep-14	30.7	44.5	723	<50	182	56	<50	<50	96.2	172	128
C	W02	29-Sep-14	29.5	41.3	1320	140	<50	74.1	<50	<50	166	189	147
C	W03	06-Oct-14	30.2	35.1	625	120	<50	79.8	<50	53.3	360	147	86.2
C	W04	13-Oct-14	26.8	35.7	339	58.2	<50	77	52.8	66.1	67	135	89.4
C	W05	20-Oct-14	29.2	35.9	575	96	<50	78.9	103	195	72.8	128	106
C	W06	27-Oct-14	27.7	43.2	1930	252	64.6	123	113	847	R	140	113
C	W07	03-Nov-14	28.8	32.0	483	113	59.9	122	80.5	148	66.4	143	106
C	W08	10-Nov-14	27.9	29.8	2290	329	67.6	126	64.4	79.8	147	134	90
C	W09	17-Nov-14	27.9	29.2	1140	152	54.6	101	79.2	111	154	215	188
C	W10	24-Nov-14	27.0	29.2	3480	167	73.4	85.4	168	<50	119	194	163
C	W11	01-Dec-14	25.9	28.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	25.5	27.8	5510	1470	1360	130	454	<50	1330	167	161
C	W13	15-Dec-14	25.1	26.2	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	24.1	25.4	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	23.3	24.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	22.7	25.7	1060	82.9	813	91.7	92	<50	<50	113	148
TR01	W01	12-Jan-15	21.6	27.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	20.4	25.9	2050	60.4	<50	103	86.9	<50	<50	102	95.6
TR01	W03	26-Jan-15	21.9	30.8	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	27.0	32.0	2260	<50	320	126	115	<50	202	164	148
TR01	W05	09-Feb-15	27.8	30.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W06	16-Feb-15	28.7	29.4	2580	314	<50	120	163	<50	97.9	141	124
TR01	W07	23-Feb-15	28.7	25.2	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W08	02-Mar-15	28.2	24.9	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W09	09-Mar-15	29.3	28.1	1600	<50	<50	121	100	<50	<50	130	118
TR01	W10	16-Mar-15	29.5	29.7	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W11	23-Mar-15	34.9	36.4	2290	173	52.9	133	182	<50	99.2	168	289
TR01	W12	30-Mar-15	34.4	38.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W00	06-Apr-15	32.3	36	2610	194	<50	82.3	101	<50	85.2	192	187
TR02	W01	13-Apr-15	38	39.8	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W02	20-Apr-15	36.7	39.3	2810	240	<50	141	1100	59.9	2200	226	213
TR02	W03	27-Apr-15	36.1	39.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W04	04-May-15	35.2	39.1	2220	292	1370	111	114	52.2	956	197	179
TR02	W05	11-May-15	33.4	37.8	NS	NS	NS	NS	NS	NS	NS	NS	NS

NOTES:

Non-detects are reported as less than the laboratory Reporting Limit (RL) and estimated as zero for calculations and graphing (Colorado Department of Public Health and Environment Water Quality Control Commission 5 CCR 1002-34).

AC1EFF = Aeration Channel Effluent/Rock Drain Influent

AC2EFF = Aeration Cascade Effluent

BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent

C = Colonization

FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)

Flow H = horizontal treatment train average flow rate

Flow V = vertical treatment train average flow rate

gpm = gallons per minute

HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent

NS = not sampled

OU = operable unit

R = rejected

RDEFF = Rock Drain Effluent

RL = reporting limit

SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent

SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent

SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent

TR** = Test Run

µg/L = microgram per liter

VWTT = Vertical Wetland Treatment Train

W** = Week of Treatability Study Phase

¹ The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.² The Aeration Cascade in the VWTT was bypassed on different occasions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 3. Cadmium, Dissolved (µg/L)

Horizontal and Vertical Wetland Treatment Trains

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H ¹ (gpm)	FLOW V ^{1,2} (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	19.6	18.9	18.4	<0.5	<0.5	<0.5	19.1	<0.5	<0.5
C	W01	22-Sep-14	30.7	44.5	20.2	19.4	19	<0.5	<0.5	<0.5	18.8	<0.5	<0.5
C	W02	29-Sep-14	29.5	41.3	22.5	21.2	20.4	<0.5	<0.5	<0.5	21.2	<0.5	<0.5
C	W03	06-Oct-14	30.2	35.1	22.3	21.5	21	<0.5	<0.5	<0.5	22.1	<0.5	<0.5
C	W04	13-Oct-14	26.8	35.7	23	21.9	20.7	<0.5	<0.5	<0.5	22.1	<0.5	<0.5
C	W05	20-Oct-14	29.2	35.9	23.4	23.6	23.6	0.6	<0.5	<0.5	24.1	<0.5	<0.5
C	W06	27-Oct-14	27.7	43.2	22.7	21.9	21.6	<0.5	<0.5	<0.5	R	<0.5	<0.5
C	W07	03-Nov-14	28.8	32.0	20.4	21.2	21.1	1.1	0.51	<0.5	21.6	<0.5	<0.5
C	W08	10-Nov-14	27.9	29.8	22.6	21.9	21.4	<0.5	<0.5	<0.5	22.1	<0.5	<0.5
C	W09	17-Nov-14	27.9	29.2	21.4	20	20	<0.5	<0.5	<0.5	20.7	<0.5	<0.5
C	W10	24-Nov-14	27.0	29.2	20.2	19	19.2	<0.5	<0.5	<0.5	19	<0.5	<0.5
C	W11	01-Dec-14	25.9	28.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	25.5	27.8	21.5	20	19.7	1.1	1	<0.5	19.6	<0.5	<0.5
C	W13	15-Dec-14	25.1	26.2	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	24.1	25.4	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	23.3	24.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	22.7	25.7	19.1	17.8	17.7	<0.5	<0.5	<0.5	17.9	<0.5	<0.5
TR01	W01	12-Jan-15	21.6	27.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	20.4	25.9	18.6	16.8	16.3	<0.5	<0.5	<0.5	17.6	<0.5	<0.5
TR01	W03	26-Jan-15	21.9	30.8	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	27	32	18.3	16.9	16.7	<0.5	<0.5	<0.5	17.2	<0.5	<0.5
TR01	W05	09-Feb-15	27.8	30.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W06	16-Feb-15	28.7	29.4	19.4	18.5	17.4	<0.5	<0.5	<0.5	16.9	<0.5	<0.5
TR01	W07	23-Feb-15	28.7	25.2	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W08	02-Mar-15	28.2	24.9	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W09	09-Mar-15	29.3	28.1	18.7	17.1	16.5	<0.5	<0.5	<0.5	16.9	<0.5	<0.5
TR01	W10	16-Mar-15	29.5	29.7	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W11	23-Mar-15	34.9	36.4	23.7	22.3	21.4	<0.5	<0.5	<0.5	23.6	<0.5	<0.5
TR01	W12	30-Mar-15	34.4	38.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W00	06-Apr-15	32.3	36	18.7	18	17	<0.5	<0.5	<0.5	18.1	<0.5	<0.5
TR02	W01	13-Apr-15	38	39.8	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W02	20-Apr-15	36.7	39.3	16.3	15.6	14.9	<0.5	0.75	<0.5	16.1	<0.5	<0.5
TR02	W03	27-Apr-15	36.1	39.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W04	04-May-15	35.2	39.1	18.9	30.2	27.5	<0.5	<0.5	<0.5	17.8	<0.5	<0.5
TR02	W05	11-May-15	33.4	37.8	NS	NS	NS	NS	NS	NS	NS	NS	NS

NOTES:

Non-detects are reported as less than the laboratory Reporting Limit (RL) and estimated as zero for calculations and graphing (Colorado Department of Public Health and Environment Water Quality Control Commission 5 CCR 1002-34).

AC1EFF = Aeration Channel Effluent/Rock Drain Influent

AC2EFF = Aeration Cascade Effluent

BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent

C = Colonization

FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)

Flow H = horizontal treatment train average flow rate

Flow V = vertical treatment train average flow rate

gpm = gallons per minute

HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent

NS = not sampled

OU = operable unit

R = rejected

RDEFF = Rock Drain Effluent

RL = reporting limit

SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent

SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent

SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent

TR** = Test Run

µg/L = microgram per liter

VWTT = Vertical Wetland Treatment Train

W** = Week of Treatability Study Phase

¹ The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.² The Aeration Cascade in the VWTT was bypassed on different occasions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 4. Zinc, Dissolved (µg/L)

Horizontal and Vertical Wetland Treatment Trains

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H ¹ (gpm)	FLOW V ^{1,2} (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	3500	3140	3020	60.6	<10	62.5	3120	52 J	148
C	W01	22-Sep-14	30.7	44.5	3800 J	3240	3210	<10	27	30	3100	12.8	<10
C	W02	29-Sep-14	29.5	41.3	4000	3520	3320	30.3	<10	<10	3450 J	10.8	279
C	W03	06-Oct-14	30.2	35.1	3970	3570	3440	115	37.9	102	3530	32.7	<10
C	W04	13-Oct-14	26.8	35.7	4000	3360	3060	90.4	60.5	53	3650	76.2	59.4
C	W05	20-Oct-14	29.2	35.9	4160	3610	3560	156	70	69.3	3840	56.4	65.7
C	W06	27-Oct-14	27.7	43.2	4120	3690	3530	79.9	47.8	47.9	R	<10	46.9
C	W07	03-Nov-14	28.8	32.0	3790	3460	3340	391	190	54	3650	83.3	91.7
C	W08	10-Nov-14	27.9	29.8	4230	3740	3590	152	48.3	<10	3810	15.2	49.4
C	W09	17-Nov-14	27.9	29.2	3770	3260	3370	74	44.1	23.5	3500	50.5	48.8
C	W10	24-Nov-14	27.0	29.2	3760	3220	3170	105	168	159	3320	41.8	54.5
C	W11	01-Dec-14	25.9	28.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	25.5	27.8	3900	3350	3350	503	439	106	3430	380	368
C	W13	15-Dec-14	25.1	26.2	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	24.1	25.4	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	23.3	24.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	22.7	25.7	3470	2830	2900	21.5	15.3	38.3	3010 J	26.9	26.1
TR01	W01	12-Jan-15	21.6	27.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	20.4	25.9	3610	2640	2560	20.7	11.1	42.7	3100	33.5	25.3
TR01	W03	26-Jan-15	21.9	30.8	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	27	32	3520	2980	2880	129	20.5	52.9	3120	89.4	63.7
TR01	W05	09-Feb-15	27.8	30.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W06	16-Feb-15	28.7	29.4	3740	3100	2900	84.8	38	48.5	3160	30.6	38.4
TR01	W07	23-Feb-15	28.7	25.2	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W08	02-Mar-15	28.2	24.9	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W09	09-Mar-15	29.3	28.1	3290	2780	2710	19.1	16.6	57.1	2870 J	117	16.7
TR01	W10	16-Mar-15	29.5	29.7	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W11	23-Mar-15	34.9	36.4	4270	3750	3610	<10	<10	52.4	3960	30.4	24.2
TR01	W12	30-Mar-15	34.4	38.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W00	06-Apr-15	32.3	36	3540	2920	2710	28.2	<10	44	3220	14.2	12.7
TR02	W01	13-Apr-15	38	39.8	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W02	20-Apr-15	36.7	39.3	3060	2660	2390	68.3	333	38.2	2960	12.6	10.7
TR02	W03	27-Apr-15	36.1	39.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W04	04-May-15	35.2	39.1	3490	5240	5090	32.6	<10	62.2	3070	23.2	34.7
TR02	W05	11-May-15	33.4	37.8	NS	NS	NS	NS	NS	NS	NS	NS	NS

NOTES:

Non-detects are reported as less than the laboratory Reporting Limit (RL) and estimated as zero for calculations and graphing (Colorado Department of Public Health and Environment Water Quality Control Commission 5 CCR 1002-34).

AC1EFF = Aeration Channel Effluent/Rock Drain Influent

AC2EFF = Aeration Cascade Effluent

BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent

C = Colonization

FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)

Flow H = horizontal treatment train average flow rate

Flow V = vertical treatment train average flow rate

gpm = gallons per minute

HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent

J = Laboratory flag indicating estimated value between the MDL and the laboratory RL.

MDL = method detection limit

NS = not sampled

OU = operable unit

R = rejected

RDEFF = Rock Drain Effluent

RL = reporting limit

SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent

SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent

SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent

TR** = Test Run

µg/L = microgram per liter

VWTT = Vertical Wetland Treatment Train

W** = Week of Treatability Study Phase

¹ The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.² The Aeration Cascade in the VWTT was bypassed on different occasions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 5. Manganese, Dissolved (µg/L)

Horizontal and Vertical Wetland Treatment Trains

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H ¹ (gpm)	FLOW V ^{1,2} (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	2080	2100	2040 J	1730 J	1610	1760	2110	1690	1700
C	W01	22-Sep-14	30.7	44.5	2160 J	2100	2110	1860 J	1630	1620	2110	2000	1970
C	W02	29-Sep-14	29.5	41.3	2200	2200	2100	1800	1660	1500	2140 J	2170 J	2110
C	W03	06-Oct-14	30.2	35.1	2260	2250	2230	1930	1840	1750 J	2280	2220 J	2160
C	W04	13-Oct-14	26.8	35.7	2310 B	2310 B	2180 B	2000 B	1950 B	1970 B	2310 B	2030 B	2040 B
C	W05	20-Oct-14	29.2	35.9	2270	2440	2370	2000 J	1990	2030	2360	1780	1820
C	W06	27-Oct-14	27.7	43.2	2220	2300	2240	1960	1950	1650 J	R	1470	1520
C	W07	03-Nov-14	28.8	32.0	2250	2260	2270	1490	1540	594 J	2270	1750	1750
C	W08	10-Nov-14	27.9	29.8	2400	2430	2390	1080	1280	293 J	2300 J	1690 J	1750
C	W09	17-Nov-14	27.9	29.2	2260	2240	2340	904 J	1020	396 J	2220	1670	1680
C	W10	24-Nov-14	27.0	29.2	2180	2170	2160	695 J	843	106 J	2110	1410	1340
C	W11	01-Dec-14	25.9	28.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	25.5	27.8	2200	2220	2200	686	825	232	2200	568	571
C	W13	15-Dec-14	25.1	26.2	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	24.1	25.4	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	23.3	24.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	22.7	25.7	2150	2150	2110	717	734	141	2130 J	519	520
TR01	W01	12-Jan-15	21.6	27.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	20.4	25.9	2070	2000	2020	819 J	737	190	2130	592 J	618
TR01	W03	26-Jan-15	21.9	30.8	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	27	32	2070	2070	2020	1110	931	654	2070	1290	1270
TR01	W05	09-Feb-15	27.8	30.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W06	16-Feb-15	28.7	29.4	2100	2060	1960	1100	917	721	2050	525	521
TR01	W07	23-Feb-15	28.7	25.2	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W08	02-Mar-15	28.2	24.9	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W09	09-Mar-15	29.3	28.1	2090	2040	1970	930 J	812	641	1840 J	489	500
TR01	W10	16-Mar-15	29.5	29.7	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W11	23-Mar-15	34.9	36.4	2070	2070	2040	1050 J	904	1020	2160	566	558
TR01	W12	30-Mar-15	34.4	38.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W00	06-Apr-15	32.3	36	1870 B	1880 B	1880 B	969 B	830 B	913 B	1910 B	1040 J	1040 B
TR02	W01	13-Apr-15	38	39.8	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W02	20-Apr-15	36.7	39.3	1840	1900	1840	927	912	732 J	1870	816	844 J
TR02	W03	27-Apr-15	36.1	39.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W04	04-May-15	35.2	39.1	1910	2230	2170	976	893	949	1830	718	689
TR02	W05	11-May-15	33.4	37.8	NS	NS	NS	NS	NS	NS	NS	NS	NS

NOTES:

Non-detects are reported as less than the laboratory Reporting Limit (RL) and estimated as zero for calculations and graphing (Colorado Department of Public Health and Environment Water Quality Control Commission 5 CCR 1002-34).

AC1EFF = Aeration Channel Effluent/Rock Drain Influent

AC2EFF = Aeration Cascade Effluent

B = Laboratory flag indicating blank contamination

BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent

C = Colonization

FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)

Flow H = horizontal treatment train average flow rate

Flow V = vertical treatment train average flow rate

gpm = gallons per minute

HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent

J = Laboratory flag indicating estimated value between the MDL and the laboratory RL.

MDL = method detection limit

NS = not sampled

OU = operable unit

R = rejected

RDEFF = Rock Drain Effluent

RL = reporting limit

SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent

SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent

SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent

TR** = Test Run

µg/L = microgram per liter

VWTT = Vertical Wetland Treatment Train

W** = Week of Treatability Study Phase

¹ The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.² The Aeration Cascade in the VWTT was bypassed on different occasions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 6. Total Suspended Solids (mg/L)

Horizontal and Vertical Wetland Treatment Trains

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H ¹ (gpm)	FLOW V ^{1,2} (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	6	<5	<5	<5	<5	<5	<5	<5	<5
C	W01	22-Sep-14	30.7	44.5	6	12	<5	<5	6	<5	<5	<5	<5
C	W02	29-Sep-14	29.5	41.3	8	<5	6	<5	10	<5	9	<5	<5
C	W03	06-Oct-14	30.2	35.1	<5	<5	6	<5	<5	<5	<5	<5	<5
C	W04	13-Oct-14	26.8	35.7	11	10	14	<5	5	<5	15	<5	<5
C	W05	20-Oct-14	29.2	35.9	17	7	9	<5	22	<5	12	6	12
C	W06	27-Oct-14	27.7	43.2	<5	7	<5	<5	<5	5	R	<5	<5
C	W07	03-Nov-14	28.8	32.0	11	6	8	<5	<5	<5	<5	<5	<5
C	W08	10-Nov-14	27.9	29.8	<5	7	6	<5	<5	<5	11	5	10
C	W09	17-Nov-14	27.9	29.2	12	13	15	80	30	11	15	<5	14
C	W10	24-Nov-14	27.0	29.2	42	10	7	<5	15	<5	7	6	14
C	W11	01-Dec-14	25.9	28.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	25.5	27.8	14	9	<5	<5	<5	<5	<5	<5	<5
C	W13	15-Dec-14	25.1	26.2	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	24.1	25.4	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	23.3	24.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	22.7	25.7	9	6	9	7	10	8	<5	7	8
TR01	W01	12-Jan-15	21.6	27.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	20.4	25.9	16	5	6	<5	18	<5	6	<5	<5
TR01	W03	26-Jan-15	21.9	30.8	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	27	32	20	11	10	<5	14	6	<5	<5	<5
TR01	W05	09-Feb-15	27.8	30.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W06	16-Feb-15	28.7	29.4	24	12	6	5	8	<5	6	<5	<5
TR01	W07	23-Feb-15	28.7	25.2	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W08	02-Mar-15	28.2	24.9	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W09	09-Mar-15	29.3	28.1	29	10	11	6	8	5	<5	9	7
TR01	W10	16-Mar-15	29.5	29.7	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W11	23-Mar-15	34.9	36.4	28	38	19	11	53	9	15	9	18
TR01	W12	30-Mar-15	34.4	38.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W00	06-Apr-15	32.3	36	13	7	7	<5	6	<5	<5	8	9
TR02	W01	13-Apr-15	38	39.8	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W02	20-Apr-15	36.7	39.3	17	14	<5	<5	<5	6	8	<5	7
TR02	W03	27-Apr-15	36.1	39.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W04	04-May-15	35.2	39.1	27	<5	6	<5	10	<5	10	7	7
TR02	W05	11-May-15	33.4	37.8	NS	NS	NS	NS	NS	NS	NS	NS	NS

NOTES:

Non-detects are reported as less than the laboratory Reporting Limit (RL) and estimated as zero for calculations and graphing (Colorado Department of Public Health and Environment Water Quality Control Commission 5 CCR 1002-34).

AC1EFF = Aeration Channel Effluent/Rock Drain Influent

AC2EFF = Aeration Cascade Effluent

BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent

C = Colonization

FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)

Flow H = Horizontal Treatment Train average flow rate

Flow V = Vertical Treatment Train average flow rate

gpm = gallons per minute

HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent

mg/L = milligram per liter

NS = not sampled

OU = operable unit

R = rejected

RDEFF = Rock Drain Effluent

RL = reporting limit

SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent

SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent

SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent

TR** = Test Run

VWTT = Vertical Wetland Treatment Train

W** = Week of Treatability Study Phase

¹ The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.² The Aeration Cascade in the VWTT was bypassed on different occasions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 7. Total Organic Carbon (mg/L)

Horizontal and Vertical Wetland Treatment Trains

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H ¹ (gpm)	FLOW V ^{1,2} (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	NR	<1	<1	12.7	24.9	21.5	<1	38	31.6
C	W01	22-Sep-14	30.7	44.5	NR	1.3	<1	6.8	11.7	12.5	1	21	19.7
C	W02	29-Sep-14	29.5	41.3	NR	<1	<1	5.9	9	9.1	1.3	10.6	9.2
C	W03	06-Oct-14	30.2	35.1	NR	<1	<1	4.2	7.4	7.6	<1	9.2	7.8
C	W04	13-Oct-14	26.8	35.7	NR	<1	<1	3.2	4.9	5.2	1.1	6.2 J	5.3
C	W05	20-Oct-14	29.2	35.9	NR	<1	<1	3	4.2	4.4	<1	4.6	4.4
C	W06	27-Oct-14	27.7	43.2	NR	<1	<1	2.9	4	6.5	R	3.5	3.3
C	W07	03-Nov-14	28.8	32.0	NR	<1	<1	1.6	2.6	2.5	<1	2.6	2.6
C	W08	10-Nov-14	27.9	29.8	NR	<1	<1	1.6	2.5	2.1	<1	2.4	2.4
C	W09	17-Nov-14	27.9	29.2	NR	<1	<1	1.7	2.5	2	<1	2.5	2.4
C	W10	24-Nov-14	27.0	29.2	NR	<1	<1	1.3	2.2	1.5	<1	2.3	2.5
C	W11	01-Dec-14	25.9	28.5	NR	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	25.5	27.8	NR	<1	1.8	1.8	2.8	1.6	<1	2	1.9
C	W13	15-Dec-14	25.1	26.2	NR	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	24.1	25.4	NR	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	23.3	24.5	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	22.7	25.7	NR	<1	<1	1.5	2.4	1.4 J	<1	1.9	2.1
TR01	W01	12-Jan-15	21.6	27.3	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	20.4	25.9	NR	<1	<1	1.3	1.7	1.2 J	<1	1.6	1.7
TR01	W03	26-Jan-15	21.9	30.8	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	27	32	NR	<1	<1	1.3	1.6	1.3	<1	1.9	2.6
TR01	W05	09-Feb-15	27.8	30.3	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W06	16-Feb-15	28.7	29.4	NR	<1	<1	1.2	1.3	1.1	<1	1.1	1.2
TR01	W07	23-Feb-15	28.7	25.2	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W08	02-Mar-15	28.2	24.9	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W09	09-Mar-15	29.3	28.1	NR	<1	<1	1.1	1.6	1.3	<1	1.3	1.4
TR01	W10	16-Mar-15	29.5	29.7	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W11	23-Mar-15	34.9	36.4	NR	<1	<1	<1	1.4	1.2	<1	1.9	2.4
TR01	W12	30-Mar-15	34.4	38.5	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W00	06-Apr-15	32.3	36	NR	<1	<1	<1	1.1	<1	<1	<1	<1
TR02	W01	13-Apr-15	38	39.8	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W02	20-Apr-15	36.7	39.3	NR	<1	<1	2.7	1.1	<1	<1	<1	1
TR02	W03	27-Apr-15	36.1	39.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W04	04-May-15	35.2	39.1	NR	<1	<1	<1	1.5	1.7	<1	1.4	1.3
TR02	W05	11-May-15	33.4	37.8	NS	NS	NS	NS	NS	NS	NS	NS	NS

NOTES:

Non-detects are reported as less than the laboratory Reporting Limit (RL) and estimated as zero for calculations and graphing (Colorado Department of Public Health and Environment Water Quality Control Commission 5 CCR 1002-34).

AC1EFF = Aeration Channel Effluent/Rock Drain Influent

AC2EFF = Aeration Cascade Effluent

BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent

C = Colonization

FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)

Flow H = Horizontal Treatment Train average flow rate

Flow V = Vertical Treatment Train average flow rate

gpm = gallons per minute

HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent

J = Laboratory flag indicating estimated value between the MDL and the laboratory RL.

MDL = method detection limit

mg/L = milligram per liter

NR = not required

NS = not sampled

OU = operable unit

R = rejected

RDEFF = Rock Drain Effluent

RL = reporting limit

SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent

SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent

SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent

TR** = Test Run

VWTT = Vertical Wetland Treatment Train

W** = Week of Treatability Study Phase

¹ The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.² The Aeration Cascade in the VWTT was bypassed on different occasions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 8. Biological Oxygen Demand, 5 day (mg/L)

Horizontal and Vertical Wetland Treatment Trains

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H ¹ (gpm)	FLOW V ^{1,2} (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	NR	<2	<2	29.3	R	R	<2	77.4	53.4
C	W01	22-Sep-14	30.7	44.5	NR	<2	<2	22.1	30.3	18.8	<2	29.3	28.1
C	W02	29-Sep-14	29.5	41.3	NR	<2	<2	9.4	23.8	10.3	<2	20.3	10.9
C	W03	06-Oct-14	30.2	35.1	NR	<2	<2	7.8	15.7	9.7	<2	20.1	12.6
C	W04	13-Oct-14	26.8	35.7	NR	<2	<2	2.8	7.6	4.5	<2	16.4	17.2
C	W05	20-Oct-14	29.2	35.9	NR	<2	<2	<2	3.5	2.6	<2	10.9	15.7
C	W06	27-Oct-14	27.7	43.2	NR	<2	<2	3.1	2	<2	<2	11.5	8.4
C	W07	03-Nov-14	28.8	32.0	NR	<2	<2	2	2.6	2.3	<2	8	4.7
C	W08	10-Nov-14	27.9	29.8	NR	<2	<2	2.1	2	<2	<2	9.7	3.5
C	W09	17-Nov-14	27.9	29.2	NR	<2	<2	2.9	<2	2	<2	9.6	6.4
C	W10	24-Nov-14	27.0	29.2	NR	<2	<2	3.2	4.2	<2	<2	7.8	4.2
C	W11	01-Dec-14	25.9	28.5	NR	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	25.5	27.8	NR	<2	<2	5.1	3.8	<2	<2	6.5	2.6
C	W13	15-Dec-14	25.1	26.2	NR	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	24.1	25.4	NR	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	23.3	24.5	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	22.7	25.7	NR	<2	<2	5.1	2.4	<2	<2	3.6	2.4
TR01	W01	12-Jan-15	21.6	27.3	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	20.4	25.9	NR	<2	<2	4.9	3.1	<2	<2	5.2	<2
TR01	W03	26-Jan-15	21.9	30.8	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	27	32	NR	<2	<2	7.6	6.3	<2	<2	5.3	3.1
TR01	W05	09-Feb-15	27.8	30.3	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W06	16-Feb-15	28.7	29.4	NR	<2	<2	<2	2.1	<2	<2	4.4	<2
TR01	W07	23-Feb-15	28.7	25.2	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W08	02-Mar-15	28.2	24.9	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W09	09-Mar-15	29.3	28.1	NR	<2	<2	6.4	2	<2	<2	4.8	2.6
TR01	W10	16-Mar-15	29.5	29.7	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W11	23-Mar-15	34.9	36.4	NR	<2	<2	2.3	6	<2	<2	3.7	2.9
TR01	W12	30-Mar-15	34.4	38.5	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W00	06-Apr-15	32.3	36	NR	<2	<2	3.2	<2	<2	<2	2.8	<2
TR02	W01	13-Apr-15	38	39.8	NR	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W02	20-Apr-15	36.7	39.3	NR	<2	<2	2.5	<2	<2	<2	3	<2
TR02	W03	27-Apr-15	36.1	39.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W04	04-May-15	35.2	39.1	NR	<2	<2	<2	<2	<2	<2	2.1	<2
TR02	W05	11-May-15	33.4	37.8	NS	NS	NS	NS	NS	NS	NS	NS	NS

NOTES:

Non-detects are reported as less than the laboratory Reporting Limit (RL) and estimated as zero for calculations and graphing (Colorado Department of Public Health and Environment Water Quality Control Commission 5 CCR 1002-34).

AC1EFF = Aeration Channel Effluent/Rock Drain Influent

AC2EFF = Aeration Cascade Effluent

BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent

C = Colonization

FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)

Flow H = Horizontal Treatment Train average flow rate

Flow V = Vertical Treatment Train average flow rate

gpm = gallons per minute

HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent

mg/L = milligram per liter

NR = not required

NS = not sampled

OU = operable unit

R = rejected

RDEFF = Rock Drain Effluent

RL = reporting limit

SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent

SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent

SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent

TR** = Test Run

VWTT = Vertical Wetland Treatment Train

W** = Week of Treatability Study Phase

¹ The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.² The Aeration Cascade in the VWTT was bypassed on different occasions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 9. Sulfate (mg/L)

Horizontal and Vertical Wetland Treatment Trains

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H ¹ (gpm)	FLOW V ^{1,2} (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	595	579	575	603	551	571	571	497	523
C	W01	22-Sep-14	30.7	44.5	710	650	724	637	620	555 J	589	582	656
C	W02	29-Sep-14	29.5	41.3	574	615	612	605	587	565	613	573	580 J
C	W03	06-Oct-14	30.2	35.1	570	630	618	707	580	618	622	522	562
C	W04	13-Oct-14	26.8	35.7	632	637	647	660	655	648	644	615 J	612
C	W05	20-Oct-14	29.2	35.9	555	551	584	558	557	574	545	543	552
C	W06	27-Oct-14	27.7	43.2	629	614	596	625	637	673	R	602	606
C	W07	03-Nov-14	28.8	32.0	536	514	526	552	542	535	536	530	525
C	W08	10-Nov-14	27.9	29.8	616	623	640	617	644	815	627	646	657
C	W09	17-Nov-14	27.9	29.2	601	635	584	587 J	901	683	606	591	574
C	W10	24-Nov-14	27.0	29.2	638	662	636	685	749	680	654	674	638
C	W11	01-Dec-14	25.9	28.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	25.5	27.8	645	623	633	672	687	614	663	597	625
C	W13	15-Dec-14	25.1	26.2	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	24.1	25.4	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	23.3	24.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	22.7	25.7	673	646	707	631	668	701	652	648	645
TR01	W01	12-Jan-15	21.6	27.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	20.4	25.9	670	565	582	596	600	617	678	639	801 J
TR01	W03	26-Jan-15	21.9	30.8	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	27	32	650	608	623	617	612	609	583	652	653
TR01	W05	09-Feb-15	27.8	30.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W06	16-Feb-15	28.7	29.4	601	664	637	661	709	670	687	642	656
TR01	W07	23-Feb-15	28.7	25.2	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W08	02-Mar-15	28.2	24.9	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W09	09-Mar-15	29.3	28.1	613	629	658	631	629	626	703 J	639	594
TR01	W10	16-Mar-15	29.5	29.7	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W11	23-Mar-15	34.9	36.4	672	654	760	703	678	672	659	639	631
TR01	W12	30-Mar-15	34.4	38.5	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W00	06-Apr-15	32.3	36	613	703	685	674	631	678	678	648	604 J
TR02	W01	13-Apr-15	38	39.8	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W02	20-Apr-15	36.7	39.3	616	623	623	631	641	637	631	625	637
TR02	W03	27-Apr-15	36.1	39.3	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W04	04-May-15	35.2	39.1	660	640	646	636	748	630	606	601	595
TR02	W05	11-May-15	33.4	37.8	NS	NS	NS	NS	NS	NS	NS	NS	NS

NOTES:

Non-detects are reported as less than the laboratory Reporting Limit (RL) and estimated as zero for calculations and graphing (Colorado Department of Public Health and Environment Water Quality Control Commission 5 CCR 1002-34).

AC1EFF = Aeration Channel Effluent/Rock Drain Influent

AC2EFF = Aeration Cascade Effluent

BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent

C = Colonization

FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)

Flow H = Horizontal Treatment Train average flow rate

Flow V = Vertical Treatment Train average flow rate

gpm = gallons per minute

HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent

J = Laboratory flag indicating estimated value between the MDL and the laboratory RL.

MDL = method detection limit

OU = operable unit

R = rejected

RDEFF = Rock Drain Effluent

RL = reporting limit

SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent

SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent

SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent

TR** = Test Run

VWTT = Vertical Wetland Treatment Train

W** = Week of Treatability Study Phase

¹The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.²The Aeration Cascade in the VWTT was bypassed on different occasions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 10. Turbidity (NTU)

Horizontal and Vertical Wetland Treatment Trains

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H ¹ (gpm)	FLOW V ^{1,2} (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	18	3	5	R	44	7	8	R	R
C	W01	22-Sep-14	30.7	44.5	18	7	4	11	49	13	4	3	13
C	W02	29-Sep-14	29.5	41.3	22	8	7	8	35	35	7	7	16
C	W03	06-Oct-14	30.2	35.1	NM	7	6	9	32	48	5	6	26
C	W04	13-Oct-14	26.8	35.7	31	8	7	14	56	47	12	7	35
C	W05	20-Oct-14	29.2	35.9	39	9	8	11	60	14	11	9	103
C	W06	27-Oct-14	27.7	43.2	38	9	6	7	33	14	5	5	38
C	W07	03-Nov-14	28.8	32.0	38	9	8	5	21	3	6	3	28
C	W08	10-Nov-14	27.9	29.8	31	5	6	2	25	0	4	5	19
C	W09	17-Nov-14	27.9	29.2	30	8	7	5	23	2	8	5	25
C	W10	24-Nov-14	27.0	29.2	46	59	17	8	43	1	7	17	146
C	W11	01-Dec-14	25.9	28.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W12	08-Dec-14	25.5	27.8	33	7	6	2	31	0	8	5	44
C	W13	15-Dec-14	25.1	26.2	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W14	22-Dec-14	24.1	25.4	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W15	29-Dec-14	23.3	24.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W00	05-Jan-15	22.7	25.7	33	12	4	4	38	1	14	3	37
TR01	W01	12-Jan-15	21.6	27.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W02	19-Jan-15	20.4	25.9	31	40	4	3	47	1	16	3	33
TR01	W03	26-Jan-15	21.9	30.8	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W04	02-Feb-15	27	32	29	9	6	4	44	3	9	4	22
TR01	W05	09-Feb-15	27.8	30.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W06	16-Feb-15	28.7	29.4	38	11	6	4	50	2	6	3	23
TR01	W07	23-Feb-15	28.7	25.2	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W08	02-Mar-15	28.2	24.9	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W09	09-Mar-15	29.3	28.1	45	6	4	3	41	3	5	1	23
TR01	W10	16-Mar-15	29.5	29.7	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W11	23-Mar-15	34.9	36.4	42	42	19	5	78	1	12	4	22
TR01	W12	30-Mar-15	34.4	38.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR02	W00	06-Apr-15	32.3	36	32	14	24	4	26	0	14	3	14
TR02	W01	13-Apr-15	38	39.8	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR02	W02	20-Apr-15	36.7	39.3	28	16	11	4	26	2	12	2	28
TR02	W03	27-Apr-15	36.1	39.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR02	W04	04-May-15	35.2	39.1	28	11	9	4	21	1	8	2	11
TR02	W05	11-May-15	33.4	37.8	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR02	W06	18-May-15	32.0	36.6	26	15	13	19	28	R	10	5	12

NOTES:

Values presented for physical and chemical parameters are from field measurements obtained during sampling events.

AC1EFF = Aeration Channel Effluent/Rock Drain Influent

AC2EFF = Aeration Cascade Effluent

BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent

C = Colonization

FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)

Flow H = Horizontal Treatment Train average flow rate

Flow V = Vertical Treatment Train average flow rate

gpm = gallons per minute

HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent

NM = not measured

NTU = Nephelometric Turbidity Units

OU = operable unit

R = rejected

RDEFF = Rock Drain Effluent

SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent

SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent

SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent

TR** = Test Run

VWTT = Vertical Wetland Treatment Train

W** = Week of Treatability Study Phase

¹ The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.² The Aeration Cascade in the VWTT was bypassed on different occasions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 11. ORP (millivolts)

Horizontal and Vertical Wetland Treatment Trains

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H ¹ (gpm)	FLOW V ^{1,2} (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	64	151	93	-428	-296	-305	49	-444	-275
C	W01	22-Sep-14	30.7	44.5	-16	R	24	-259	-346	-277	-38	-257	-243
C	W02	29-Sep-14	29.5	41.3	-17	33	-49	-266	-272	-245	23	-265	-230
C	W03	06-Oct-14	30.2	35.1	NM	46	-26	-218	-237	-225	25	-244	-207
C	W04	13-Oct-14	26.8	35.7	32	54	-20	-192	-162	-191	-58	-226	-182
C	W05	20-Oct-14	29.2	35.9	27	65	45	-148	-51	-90	22	-180	-146
C	W06	27-Oct-14	27.7	43.2	-24	41	36	-160	-40	-60	-86	-203	-100
C	W07	03-Nov-14	28.8	32.0	27	26	34	-108	57	20	-21	-170	45
C	W08	10-Nov-14	27.9	29.8	-10	2	-29	-161	-24	-21	-43	-184	3
C	W09	17-Nov-14	27.9	29.2	26	65	61	-179	-96	-40	19	-207	-126
C	W10	24-Nov-14	27.0	29.2	21	51	29	-129	-84	20	36	-205	106
C	W11	01-Dec-14	25.9	28.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W12	08-Dec-14	25.5	27.8	-26	16	19	-215	-116	-33	-49	-235	-138
C	W13	15-Dec-14	25.1	26.2	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W14	22-Dec-14	24.1	25.4	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W15	29-Dec-14	23.3	24.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W00	05-Jan-15	22.7	25.7	5	45	27	-230	-152	33	59	-256	-177
TR01	W01	12-Jan-15	21.6	27.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W02	19-Jan-15	20.4	25.9	1	50	-27	-225	-118	81	3	-232	-148
TR01	W03	26-Jan-15	21.9	30.8	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W04	02-Feb-15	27	32	-28	51	6	-232	-132	43	-17	-250	-158
TR01	W05	09-Feb-15	27.8	30.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W06	16-Feb-15	28.7	29.4	-25	37	-26	-227	-138	26	15	-221	-151
TR01	W07	23-Feb-15	28.7	25.2	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W08	02-Mar-15	28.2	24.9	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W09	09-Mar-15	29.3	28.1	-4	86	78	-231	-184	62	96	-225	-185
TR01	W10	16-Mar-15	29.5	29.7	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W11	23-Mar-15	34.9	36.4	33	77	81	-131	-112	51	73	-132	-108
TR01	W12	30-Mar-15	34.4	38.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR02	W00	06-Apr-15	32.3	36	12	45	4	-224	-154	26	63	-235	-161
TR02	W01	13-Apr-15	38	39.8	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR02	W02	20-Apr-15	36.7	39.3	-15	33	36	-179	-159	23	87	-248	-126
TR02	W03	27-Apr-15	36.1	39.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR02	W04	04-May-15	35.2	39.1	-15	34	20	-213	-157	42	37	-243	-151
TR02	W05	11-May-15	33.4	37.8	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR02	W06	18-May-15	32.0	36.6	78	135	124	-111	-121	85	125	-141	-124

NOTES:

Values presented for physical and chemical parameters are from field measurements obtained during sampling events.

AC1EFF = Aeration Channel Effluent/Rock Drain Influent

AC2EFF = Aeration Cascade Effluent

BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent

C = Colonization

FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)

Flow H = Horizontal Treatment Train average flow rate

Flow V = Vertical Treatment Train average flow rate

gpm = gallons per minute

HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent

mV = millivolts

NM = not measured

ORP = Oxidation Reduction Potential

OU = operable unit

R = rejected

RDEFF = Rock Drain Effluent

SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent

SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent

SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent

TR** = Test Run

VWTT = Vertical Wetland Treatment Train

W** = Week of Treatability Study Phase

¹ The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.² The Aeration Cascade in the VWTT was bypassed on different occasions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 12. Dissolved Oxygen (mg/L)

Horizontal and Vertical Wetland Treatment Trains

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H ¹ (gpm)	FLOW V ^{1,2} (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	5.6	5.2	6.8	0.2	0.4	0.4	5.2	0.1	0.9
C	W01	22-Sep-14	30.7	44.5	6.6	2.1	6.1	0.9	0.1	1.7	3.5	1.8	3.1
C	W02	29-Sep-14	29.5	41.3	5.9	5.7	7	1.8	1.9	2.4	6.1	0.7	3.2
C	W03	06-Oct-14	30.2	35.1	NM	6.1	6.7	2.6	1.8	1.2	5.9	1.4	3
C	W04	13-Oct-14	26.8	35.7	6.1	6.4	7.2	3.1	3.7	1.8	5.9	1.5	2.9
C	W05	20-Oct-14	29.2	35.9	3.9	6.3	6	3.1	5.4	2.5	6.1	2.1	3.4
C	W06	27-Oct-14	27.7	43.2	6	6.2	6.1	3	6.2	2.3	6	2.5	4.3
C	W07	03-Nov-14	28.8	32.0	ns	6.4	7.3	3.4	6	3.7	6.7	3.1	5.1
C	W08	10-Nov-14	27.9	29.8	6.1	6.2	7	3.6	5.6	2.5	6	1.9	2.5
C	W09	17-Nov-14	27.9	29.2	5.5	6.2	7.3	0.3	5.2	0.2	5.6	0.5	2.8
C	W10	24-Nov-14	27.0	29.2	6	6.1	7.7	1.7	5.6	1.1	5.7	0.4	3.7
C	W11	01-Dec-14	25.9	28.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W12	08-Dec-14	25.5	27.8	5.7	6.2	7	1.7	6.1	2.6	5.9	1.8	3.6
C	W13	15-Dec-14	25.1	26.2	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W14	22-Dec-14	24.1	25.4	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W15	29-Dec-14	23.3	24.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W00	05-Jan-15	22.7	25.7	5.6	5.9	6.9	0.6	5.8	0.7	5.9	0.3	2.6
TR01	W01	12-Jan-15	21.6	27.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W02	19-Jan-15	20.4	25.9	5	6.5	6.9	0.4	5.9	0.8	5.6	0.3	2.5
TR01	W03	26-Jan-15	21.9	30.8	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W04	02-Feb-15	27.0	32.0	5.3	5.9	7	0.5	5.7	1.8	5.7	0.3	2.2
TR01	W05	09-Feb-15	27.8	30.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W06	16-Feb-15	28.7	29.4	5.3	5.9	7.4	0.5	6.1	2.6	6.7	0.6	2.6
TR01	W07	23-Feb-15	28.7	25.2	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W08	02-Mar-15	28.2	24.9	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W09	09-Mar-15	29.3	28.1	5.5	5.7	6.8	0.7	6.2	1.3	5.6	0.4	2.9
TR01	W10	16-Mar-15	29.5	29.7	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W11	23-Mar-15	34.9	36.4	5.5	5.9	6.5	0.7	5.3	1.4	5.5	0.2	2.4
TR01	W12	30-Mar-15	34.4	38.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR02	W00	06-Apr-15	32.3	36	5.5	5.4	6.7	0.5	5.4	0.8	5	0.1	2.9
TR02	W01	13-Apr-15	38	39.8	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR02	W02	20-Apr-15	36.7	39.3	5.5	6.1	6.4	0.4	5	0.4	5.7	R	3.2
TR02	W03	27-Apr-15	36.1	39.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR02	W04	04-May-15	35.2	39.1	5.5	5.6	6.4	0.4	4.5	0.9	5.4	0.3	3.9
TR02	W05	11-May-15	33.4	37.8	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR02	W06	18-May-15	32.0	36.6	5.6	5.6	6.6	0.4	5.5	0.8	5.7	0.4	4.5

NOTES:

Values presented for physical and chemical parameters are from field measurements obtained during sampling events.

AC1EFF = Aeration Channel Effluent/Rock Drain Influent

AC2EFF = Aeration Cascade Effluent

BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent

C = Colonization

FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)

Flow H = Horizontal Treatment Train average flow rate

Flow V = Vertical Treatment Train average flow rate

gpm = gallons per minute

HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent

mg/L = milligram per liter

NM = not measured

OU = operable unit

RDEFF = Rock Drain Effluent

SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent

SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent

SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent

TR** = Test Run

VWTT = Vertical Wetland Treatment Train

W** = Week of Treatability Study Phase

¹ The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.² The Aeration Cascade in the VWTT was bypassed on different occasions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 13. Total Dissolved Sulfide (mg/L)

Horizontal and Vertical Wetland Treatment Trains

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H ¹ (gpm)	FLOW V ^{1,2} (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	R	R	R	R	R	R	R	R	R
C	W01	22-Sep-14	30.7	44.5	0	0	0	1.87	0.98	1.05	0.02	1.8	2.66
C	W02	29-Sep-14	29.5	41.3	NM	0.12	0.25	3.03	3.13	2.2	0.11	7.99	1.43
C	W03	06-Oct-14	30.2	35.1	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W04	13-Oct-14	26.8	35.7	0	0.02	0.06	51.46	4.9	2.5	0.07	R	3.67
C	W05	20-Oct-14	29.2	35.9	0.11	0.03	0.11	20.82	0.61	0.51	0.24	114.7	1.37
C	W06	27-Oct-14	27.7	43.2	0	1.77	0.56	69.24	0.05	0.09	1.88	R	3.07
C	W07	03-Nov-14	28.8	32.0	0.02	0.36	1.19	54.32	1.16	0.47	0.34	61.11	0.53
C	W08	10-Nov-14	27.9	29.8	NM	NM	NM	NM	NM	NM	0.14	434.4	0.48
C	W09	17-Nov-14	27.9	29.2	0	0.63	0.67	99.72	0.89	0.22	0.19	98.46	0.97
C	W10	24-Nov-14	27.0	29.2	0	0.39	0.88	R	1.75	0.19	0.1	4.1	3.27
C	W11	01-Dec-14	25.9	28.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W12	08-Dec-14	25.5	27.8	0	0.01	1.1	R	1.46	0.06	0	62.93	3.2
C	W13	15-Dec-14	25.1	26.2	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W14	22-Dec-14	24.1	25.4	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W15	29-Dec-14	23.3	24.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W00	05-Jan-15	22.7	25.7	0	0.32	0.04	20	0.51	0.1	0.17	5.9	0.17
TR01	W01	12-Jan-15	21.6	27.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W02	19-Jan-15	20.4	25.9	0	0.07	0.11	31.25	0.42	0.11	0.33	38	1.05
TR01	W03	26-Jan-15	21.9	30.8	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W04	02-Feb-15	27	32	0	0.13	0.06	30.75	1.29	0.02	0.19	31.25	1.7
TR01	W05	09-Feb-15	27.8	30.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W06	16-Feb-15	28.7	29.4	0	0.13	0.16	6.19	0.58	0.17	0.11	9.25	0.51
TR01	W07	23-Feb-15	28.7	25.2	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W08	02-Mar-15	28.2	24.9	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W09	09-Mar-15	29.3	28.1	0	0.01	0.03	4.5	0.3	0.03	0.06	7.65	0.79
TR01	W10	16-Mar-15	29.5	29.7	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W11	23-Mar-15	34.9	36.4	0.12	0.05	0	24.25	5.81	0.09	0.18	33.25	5.8
TR01	W12	30-Mar-15	34.4	38.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR02	W00	06-Apr-15	32.3	36	0	0	0	3.75	0.07	0	0	0.74	0.07
TR02	W01	13-Apr-15	38	39.8	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR02	W02	20-Apr-15	36.7	39.3	0	0.02	0.03	3	0.58	0.01	0	0	0
TR02	W03	27-Apr-15	36.1	39.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR02	W04	04-May-15	35.2	39.1	0	0.01	0.02	2	0.48	0.02	0	3	0.75
TR02	W05	11-May-15	33.4	37.8	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR02	W06	18-May-15	32.0	36.6	0	0	0.02	2.25	0.61	0.02	0	3	0.56

NOTES:

Values presented for physical and chemical parameters are from field measurements obtained during sampling events.

AC1EFF = Aeration Channel Effluent/Rock Drain Influent

AC2EFF = Aeration Cascade Effluent

BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent

C = Colonization

FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)

Flow H = Horizontal Treatment Train average flow rate

Flow V = Vertical Treatment Train average flow rate

gpm = gallons per minute

HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent

NM = not measured

mg/L = milligram per liter

OU = operable unit

R = rejected

RDEFF = Rock Drain Effluent

SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent

SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent

SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent

TR** = Test Run

VWTT = Vertical Wetland Treatment Train

W** = Week of Treatability Study Phase

¹ The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.² The Aeration Cascade in the VWTT was bypassed on different occasions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 14. Temperature (degrees Celsius)

Horizontal and Vertical Wetland Treatment Trains

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	FLOW H ¹ (gpm)	FLOW V ^{1,2} (gpm)	FDB	SB1EFF	SFWEFF	HSSFWMP11	AC1EFF	RDEFF	SB2EFF	BTEFF	AC2EFF
C	W00	15-Sep-14	25.8	33.8	18.8	18.1	18.8	14.7	16.2	12.9	18.6	18.8	16.4
C	W01	22-Sep-14	30.7	44.5	20.1	19.1	19.3	17.9	19.1	17.2	19.2	18.3	18
C	W02	29-Sep-14	29.5	41.3	16.8	15.5	16.4	14.4	13.2	12.1	15.3	13.5	13.2
C	W03	06-Oct-14	30.2	35.1	NM	15.9	14	13.2	13.3	12.5	15.5	15.3	15.3
C	W04	13-Oct-14	26.8	35.7	18.7	17.4	18.3	15.5	15.5	18	17.5	17.5	19.4
C	W05	20-Oct-14	29.2	35.9	19.6	17.7	18.2	17.1	15.3	15.2	18	18.3	17.3
C	W06	27-Oct-14	27.7	43.2	18.8	17.7	17.5	15.3	15.4	12.1	18.3	17.3	17.5
C	W07	03-Nov-14	28.8	32.0	19.1	17.7	18.1	14.1	14.8	12.4	16.5	16.5	15.7
C	W08	10-Nov-14	27.9	29.8	15.7	15.9	15.7	13.3	13.1	11.3	15.1	14.7	14.9
C	W09	17-Nov-14	27.9	29.2	18.7	14.9	12.1	11.7	10.5	9.8	16.8	14.7	14.4
C	W10	24-Nov-14	27.0	29.2	18.1	16.3	12.9	5.7	8.4	9.1	15.6	15.1	14.1
C	W11	01-Dec-14	25.9	28.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W12	08-Dec-14	25.5	27.8	17.6	14.4	13	12.7	9.6	10.4	15.2	14.7	15.1
C	W13	15-Dec-14	25.1	26.2	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W14	22-Dec-14	24.1	25.4	NM	NM	NM	NM	NM	NM	NM	NM	NM
C	W15	29-Dec-14	23.3	24.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W00	05-Jan-15	22.7	25.7	19.2	16.1	15.5	12.1	10.9	8.9	16.7	15	13.6
TR01	W01	12-Jan-15	21.6	27.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W02	19-Jan-15	20.4	25.9	18.9	14.5	13.2	10.6	9.2	7.9	15.1	14.9	14.4
TR01	W03	26-Jan-15	21.9	30.8	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W04	02-Feb-15	27.0	32.0	19.2	16.4	16.2	12.5	11.4	9.1	16.3	15.9	15.4
TR01	W05	09-Feb-15	27.8	30.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W06	16-Feb-15	28.7	29.4	19.2	15.9	16	11.1	10	8.3	14.7	14.4	13.8
TR01	W07	23-Feb-15	28.7	25.2	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W08	02-Mar-15	28.2	24.9	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W09	09-Mar-15	29.3	28.1	19.3	16.9	16.7	13.3	12.2	10.5	15.6	14.9	14
TR01	W10	16-Mar-15	29.5	29.7	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR01	W11	23-Mar-15	34.9	36.4	18.6	16.8	16.1	14.1	13.2	12.1	16.2	15.8	15.1
TR01	W12	30-Mar-15	34.4	38.5	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR02	W00	06-Apr-15	32.3	36	18.7	17.3	17.7	14.3	14.3	12.2	16	16.1	15.5
TR02	W01	13-Apr-15	38	39.8	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR02	W02	20-Apr-15	36.7	39.3	19.3	19.4	20.6	15.5	15.7	13.1	17.4	17.1	16.2
TR02	W03	27-Apr-15	36.1	39.3	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR02	W04	04-May-15	35.2	39.1	19.2	18.4	17.7	16	16.1	13.3	17.9	16.6	16.6
TR02	W05	11-May-15	33.4	37.8	NM	NM	NM	NM	NM	NM	NM	NM	NM
TR02	W06	18-May-15	32.0	36.6	19	19.1	20	16	15.8	13.7	17.1	16.9	16.5

NOTES:

Values presented for physical and chemical parameters are from field measurements obtained during sampling events.

AC1EFF = Aeration Channel Effluent/Rock Drain Influent

AC2EFF = Aeration Cascade Effluent

BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent

C = Colonization

DEG C = degrees celsius

FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)

Flow H = Horizontal Treatment Train average flow rate

Flow V = Vertical Treatment Train average flow rate

gpm = gallons per minute

HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent

NM = not measured

OU = operable unit

RDEFF = Rock Drain Effluent

SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent

SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent

SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent

TR** = Test Run

VWTT = Vertical Wetland Treatment Train

W** = Week of Treatability Study Phase

¹ The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.² The Aeration Cascade in the VWTT was bypassed on different occasions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 15. Mass Removal

Horizontal and Vertical Wetland Treatment Trains

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	Analyte Name	FDB (µg/L)	RDEFF (µg/L)	H Δ CONC (µg/L)	H FLOW (gpm)	H FLOW TOTAL (gallons)	H REMOVAL EFFICIENCY (%)	H MASS REMOVAL RATE (g/day)	AC2EFF (µg/L)	V Δ CONC (µg/L)	V FLOW (gpm)	V FLOW TOTAL (gallons)	V REMOVAL EFFICIENCY (%)	V MASS REMOVAL RATE (g/day)
C	W00	15-Sep-14	Cadmium, Dissolved	19.6	<0.5	19.6	25.8	259,600	100	2.8	<0.5	19.6	33.8	340200	100	3.6
C	W01	22-Sep-14	Cadmium, Dissolved	20.2	<0.5	20.2	30.7	309,600	100	3.4	<0.5	20.2	44.5	448200	100	4.9
C	W02	29-Sep-14	Cadmium, Dissolved	22.5	<0.5	22.5	29.5	297,200	100	3.6	<0.5	22.5	41.3	416100	100	5.1
C	W03	06-Oct-14	Cadmium, Dissolved	22.3	<0.5	22.3	30.2	304,500	100	3.7	<0.5	22.3	35.1	353800	100	4.3
C	W04	13-Oct-14	Cadmium, Dissolved	23	<0.5	23	26.8	270,000	100	3.4	<0.5	23	35.7	359700	100	4.5
C	W05	20-Oct-14	Cadmium, Dissolved	23.4	<0.5	23.4	29.2	294,600	100	3.7	<0.5	23.4	35.9	361600	100	4.6
C	W06	27-Oct-14	Cadmium, Dissolved	22.7	<0.5	22.7	27.7	278,800	100	3.4	<0.5	22.7	43.2	435500	100	5.3
C	W07	03-Nov-14	Cadmium, Dissolved	20.4	<0.5	20.4	28.8	290,300	100	3.2	<0.5	20.4	32	322600	100	3.6
C	W08	10-Nov-14	Cadmium, Dissolved	22.6	<0.5	22.6	27.9	280,900	100	3.4	<0.5	22.6	29.8	300300	100	3.7
C	W09	17-Nov-14	Cadmium, Dissolved	21.4	<0.5	21.4	27.9	281,100	100	3.3	<0.5	21.4	29.2	294300	100	3.4
C	W10	24-Nov-14	Cadmium, Dissolved	20.2	<0.5	20.2	27.0	271,700	100	3	<0.5	20.2	29.2	294300	100	3.2
C	W11	01-Dec-14	Cadmium, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	Cadmium, Dissolved	21.5	<0.5	21.5	25.5	257,200	100	3	<0.5	21.5	27.8	279900	100	3.3
C	W13	15-Dec-14	Cadmium, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	Cadmium, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	Cadmium, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	Cadmium, Dissolved	19.1	<0.5	19.1	22.7	228,700	100	2.4	<0.5	19.1	25.7	259200	100	2.7
TR01	W01	12-Jan-15	Cadmium, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	Cadmium, Dissolved	18.6	<0.5	18.6	20.4	206,100	100	2.1	<0.5	18.6	25.9	261400	100	2.6
TR01	W03	26-Jan-15	Cadmium, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	Cadmium, Dissolved	18.3	<0.5	18.3	27.0	272,600	100	2.7	<0.5	18.3	32	322200	100	3.2
TR01	W05	09-Feb-15	Cadmium, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W06	16-Feb-15	Cadmium, Dissolved	19.4	<0.5	19.4	28.6	288,400	100	3	<0.5	19.4	29.3	295600	100	3.1
TR01	W07	23-Feb-15	Cadmium, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W08	02-Mar-15	Cadmium, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W09	09-Mar-15	Cadmium, Dissolved	18.7	<0.5	18.7	29.3	295,000	100	3	<0.5	18.7	28.1	283300	100	2.9
TR01	W10	16-Mar-15	Cadmium, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W11	23-Mar-15	Cadmium, Dissolved	23.7	<0.5	23.7	34.9	352,200	100	4.5	<0.5	23.7	36.4	367300	100	4.7
TR01	W12	30-Mar-15	Cadmium, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W00	06-Apr-15	Cadmium, Dissolved	18.7	<0.5	18.7	32.3	325,100	100	3.3	<0.5	18.7	36	362700	100	3.7
TR02	W01	13-Apr-15	Cadmium, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W02	20-Apr-15	Cadmium, Dissolved	16.3	<0.5	16.3	36.7	369,600	100	3.3	<0.5	16.3	39.3	395800	100	3.5
TR02	W03	27-Apr-15	Cadmium, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W04	04-May-15	Cadmium, Dissolved	18.9	<0.5	18.9	35.2	355,100	100	3.6	<0.5	18.9	39.1	393700	100	4
TR02	W05	11-May-15	Cadmium, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 15. Mass Removal

Horizontal and Vertical Wetland Treatment Trains

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	Analyte Name	FDB (µg/L)	RDEFF (µg/L)	H Δ CONC (µg/L)	H FLOW (gpm)	H FLOW TOTAL (gallons)	H REMOVAL EFFICIENCY (%)	H MASS REMOVAL RATE (g/day)	AC2EFF (µg/L)	V Δ CONC (µg/L)	V FLOW (gpm)	V FLOW TOTAL (gallons)	V REMOVAL EFFICIENCY (%)	V MASS REMOVAL RATE (g/day)
C	W00	15-Sep-14	Iron	4500	250	4250	25.8	259,600	94.4	597.7	246	4254	33.8	340200	94.5	783.8
C	W01	22-Sep-14	Iron	3740	170	3570	30.7	309,600	95.5	597.4	218	3522	44.5	448200	94.2	854.3
C	W02	29-Sep-14	Iron	4230	129	4101	29.5	297,200	97	659.5	210	4020	41.3	416100	95	905
C	W03	06-Oct-14	Iron	3940	134	3806	30.2	304,500	96.6	626.5	165	3775	35.1	353800	95.8	722.3
C	W04	13-Oct-14	Iron	3820	144	3676	26.8	270,000	96.2	537	154	3666	35.7	359700	96	713.4
C	W05	20-Oct-14	Iron	5730	326	5404	29.2	294,600	94.3	860.1	143	5587	35.9	361600	97.5	1093.3
C	W06	27-Oct-14	Iron	24100	1340	22760	27.7	278,800	94.4	3436.6	137	23963	43.2	435500	99.4	5642.9
C	W07	03-Nov-14	Iron	4550	297	4253	28.8	290,300	93.5	667.7	153	4397	32	322600	96.6	767
C	W08	10-Nov-14	Iron	5720	99.6	5620.4	27.9	280,900	98.3	854.8	148	5572	29.8	300300	97.4	905.1
C	W09	17-Nov-14	Iron	8800	141	8659	27.9	281,100	98.4	1316.9	260	8540	29.2	294300	97	1359.3
C	W10	24-Nov-14	Iron	5230	<50	5230	27.0	271,700	100	769.7	245	4985	29.2	294300	95.3	793.5
C	W11	01-Dec-14	Iron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	Iron	5710	<50	5710	25.5	257,200	100	793.7	156	5554	27.8	279900	97.3	841.6
C	W13	15-Dec-14	Iron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	Iron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	Iron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	Iron	6130	<50	6130	22.7	228,700	100	758.5	131	5999	25.7	259200	97.9	840.4
TR01	W01	12-Jan-15	Iron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	Iron	7510	<50	7510	20.4	206,100	100	835.1	109	7401	25.9	261400	98.5	1044.9
TR01	W03	26-Jan-15	Iron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	Iron	7980	<50	7980	27.0	272,600	100	1174.5	162	7818	32	322200	98	1363.7
TR01	W05	09-Feb-15	Iron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W06	16-Feb-15	Iron	9530	<50	9530	28.6	288,400	100	1485.7	142	9388	29.3	295600	98.5	1499.4
TR01	W07	23-Feb-15	Iron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W08	02-Mar-15	Iron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W09	09-Mar-15	Iron	10400	<50	10400	29.3	295,000	100	1661	138	10262	28.1	283300	98.7	1571.9
TR01	W10	16-Mar-15	Iron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W11	23-Mar-15	Iron	8450	<50	8450	34.9	352,200	100	1607.5	291	8159	36.4	367300	96.6	1618.9
TR01	W12	30-Mar-15	Iron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W00	06-Apr-15	Iron	9260	<50	9260	32.3	325,100	100	1630.4	202	9058	36	362700	97.8	1777.5
TR02	W01	13-Apr-15	Iron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W02	20-Apr-15	Iron	9020	<50	9020	36.7	369,600	100	1804.5	261	8759	39.3	395800	97.1	1876.4
TR02	W03	27-Apr-15	Iron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W04	04-May-15	Iron	8630	75.8	8554.2	35.2	355,100	99.1	1642.6	210	8420	39.1	393700	97.6	1794.6
TR02	W05	11-May-15	Iron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 15. Mass Removal

Horizontal and Vertical Wetland Treatment Trains

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	Analyte Name	FDB (µg/L)	RDEFF (µg/L)	H Δ CONC (µg/L)	H FLOW (gpm)	H FLOW TOTAL (gallons)	H REMOVAL EFFICIENCY (%)	H MASS REMOVAL RATE (g/day)	AC2EFF (µg/L)	V Δ CONC (µg/L)	V FLOW (gpm)	V FLOW TOTAL (gallons)	V REMOVAL EFFICIENCY (%)	V MASS REMOVAL RATE (g/day)
C	W00	15-Sep-14	Iron, Dissolved	772	76.2	695.8	25.8	259,600	90.1	97.9	174	598	33.8	340200	77.5	110.2
C	W01	22-Sep-14	Iron, Dissolved	723	<50	723	30.7	309,600	100	121	128	595	44.5	448200	82.3	144.3
C	W02	29-Sep-14	Iron, Dissolved	1320	<50	1320	29.5	297,200	100	212.3	147	1173	41.3	416100	88.9	264.1
C	W03	06-Oct-14	Iron, Dissolved	625	53.3	571.7	30.2	304,500	91.5	94.1	86.2	538.8	35.1	353800	86.2	103.1
C	W04	13-Oct-14	Iron, Dissolved	339	66.1	272.9	26.8	270,000	80.5	39.9	89.4	249.6	35.7	359700	73.6	48.6
C	W05	20-Oct-14	Iron, Dissolved	575	195	380	29.2	294,600	66.1	60.5	106	469	35.9	361600	81.6	91.8
C	W06	27-Oct-14	Iron, Dissolved	1930	847	1083	27.7	278,800	56.1	163.5	113	1817	43.2	435500	94.1	427.9
C	W07	03-Nov-14	Iron, Dissolved	483	148	335	28.8	290,300	69.4	52.6	106	377	32	322600	78.1	65.8
C	W07	03-Nov-14	Iron, Dissolved	2290	79.8	2210.2	27.9	280,900	96.5	336.1	90	2200	29.8	300300	96.1	357.4
C	W09	17-Nov-14	Iron, Dissolved	1140	111	1029	27.9	281,100	90.3	156.5	188	952	29.2	294300	83.5	151.5
C	W10	24-Nov-14	Iron, Dissolved	3480	<50	3480	27.0	271,700	100	512.2	163	3317	29.2	294300	95.3	528
C	W11	01-Dec-14	Iron, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	Iron, Dissolved	5510	<50	5510	25.5	257,200	100	765.9	161	5349	27.8	279900	97.1	810.6
C	W13	15-Dec-14	Iron, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	Iron, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	Iron, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	Iron, Dissolved	1060	<50	1060	22.7	228,700	100	131.2	148	912	25.7	259200	86	127.8
TR01	W01	12-Jan-15	Iron, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	Iron, Dissolved	2050	<50	2050	20.4	206,100	100	228	95.6	1954.4	25.9	261400	95.3	275.9
TR01	W03	26-Jan-15	Iron, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	Iron, Dissolved	2260	<50	2260	27.0	272,600	100	332.6	148	2112	32	322200	93.5	368.4
TR01	W05	09-Feb-15	Iron, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W06	16-Feb-15	Iron, Dissolved	2580	<50	2580	28.6	288,400	100	402.2	124	2456	29.3	295600	95.2	392.3
TR01	W07	23-Feb-15	Iron, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W08	02-Mar-15	Iron, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W09	09-Mar-15	Iron, Dissolved	1600	<50	1600	29.3	295000	100	255.5	118	1482	28.1	283300	92.6	227
TR01	W10	16-Mar-15	Iron, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W11	23-Mar-15	Iron, Dissolved	2290	<50	2290	34.9	352,200	100	435.6	289	2001	36.4	367300	87.4	397
TR01	W12	30-Mar-15	Iron, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W00	06-Apr-15	Iron, Dissolved	2610	<50	2610	32.3	325100	100	459.5	187	2423	36	362700	92.8	475.5
TR02	W01	13-Apr-15	Iron, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W02	20-Apr-15	Iron, Dissolved	2810	59.9	2750.1	36.7	369,600	97.9	550.2	213	2597	39.3	395800	92.4	556.3
TR02	W03	27-Apr-15	Iron, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W04	04-May-15	Iron, Dissolved	2220	52.2	2167.8	35.2	355,100	97.6	416.3	179	2041	39.1	393700	91.9	435
TR02	W05	11-May-15	Iron, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 15. Mass Removal

Horizontal and Vertical Wetland Treatment Trains

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	Analyte Name	FDB (µg/L)	RDEFF (µg/L)	H Δ CONC (µg/L)	H FLOW (gpm)	H FLOW TOTAL (gallons)	H REMOVAL EFFICIENCY (%)	H MASS REMOVAL RATE (g/day)	AC2EFF (µg/L)	V Δ CONC (µg/L)	V FLOW (gpm)	V FLOW TOTAL (gallons)	V REMOVAL EFFICIENCY (%)	V MASS REMOVAL RATE (g/day)
C	W00	15-Sep-14	Manganese, Dissolved	2080	1760	320	25.8	259,600	15.4	45	1700	380	33.8	340200	18.3	70
C	W01	22-Sep-14	Manganese, Dissolved	2160 J	1620	540	30.7	309,600	25	90.4	1970	190	44.5	448200	8.8	46.1
C	W02	29-Sep-14	Manganese, Dissolved	2200	1500	700	29.5	297,200	31.8	112.6	2110	90	41.3	416100	4.1	20.3
C	W03	06-Oct-14	Manganese, Dissolved	2260	1750 J	510	30.2	304,500	22.6	84	2160	100	35.1	353800	4.4	19.1
C	W04	13-Oct-14	Manganese, Dissolved	2310 B	1970 B	340	26.8	270,000	14.7	49.7	2040 B	270	35.7	359700	11.7	52.5
C	W05	20-Oct-14	Manganese, Dissolved	2270	2030	240	29.2	294,600	10.6	38.2	1820	450	35.9	361600	19.8	88.1
C	W06	27-Oct-14	Manganese, Dissolved	2220	1650 J	570	27.7	278,800	25.7	86.1	1520	700	43.2	435500	31.5	164.8
C	W07	03-Nov-14	Manganese, Dissolved	2250	594	1656	28.8	290,300	73.6	260	1750 J	500	32	322600	22.2	87.2
C	W08	10-Nov-14	Manganese, Dissolved	2400	293	2107	27.9	280,900	87.8	320.4	1750	650	29.8	300300	27.1	105.6
C	W09	17-Nov-14	Manganese, Dissolved	2260	396	1864	27.9	281,100	82.5	283.5	1680	580	29.2	294300	25.7	92.3
C	W10	24-Nov-14	Manganese, Dissolved	2180	106	2074	27.0	271,700	95.1	305.2	1340	840	29.2	294300	38.5	133.7
C	W11	01-Dec-14	Manganese, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	Manganese, Dissolved	2200	232	1968	25.5	257,200	89.5	273.6	571	1629	27.8	279900	74	246.9
C	W13	15-Dec-14	Manganese, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	Manganese, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	Manganese, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	Manganese, Dissolved	2150	141	2009	22.7	228,700	93.4	248.6	520	1630	25.7	259200	75.8	228.3
TR01	W01	12-Jan-15	Manganese, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	Manganese, Dissolved	2070	190	1880	20.4	206,100	90.8	209.1	618	1452	25.9	261400	70.1	205
TR01	W03	26-Jan-15	Manganese, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	Manganese, Dissolved	2070	654	1416	27.0	272,600	68.4	208.4	1270	800	32	322200	38.6	139.5
TR01	W05	09-Feb-15	Manganese, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W06	16-Feb-15	Manganese, Dissolved	2100	721	1379	28.6	288,400	65.7	215	521	1579	29.3	295600	75.2	252.2
TR01	W07	23-Feb-15	Manganese, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W08	02-Mar-15	Manganese, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W09	09-Mar-15	Manganese, Dissolved	2090	641	1449	29.3	295,000	69.3	231.4	500	1590	28.1	283300	76.1	243.5
TR01	W10	16-Mar-15	Manganese, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W11	23-Mar-15	Manganese, Dissolved	2070	1020	1050	34.9	352,200	50.7	199.8	558	1512	36.4	367300	73	300
TR01	W12	30-Mar-15	Manganese, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W00	06-Apr-15	Manganese, Dissolved	1870 B	913 B	957	32.3	325,100	51.2	168.5	1040 B	830	36	362700	44.4	162.9
TR02	W01	13-Apr-15	Manganese, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W02	20-Apr-15	Manganese, Dissolved	1840	732 J	1108	36.7	369,600	60.2	221.7	844 J	996	39.3	395800	54.1	213.4
TR02	W03	27-Apr-15	Manganese, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W04	04-May-15	Manganese, Dissolved	1910	949	961	35.2	355,100	50.3	184.5	689	1221	39.1	393700	63.9	260.2
TR02	W05	11-May-15	Manganese, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 15. Mass Removal

Horizontal and Vertical Wetland Treatment Trains

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	Analyte Name	FDB (µg/L)	RDEFF (µg/L)	H Δ CONC (µg/L)	H FLOW (gpm)	H FLOW TOTAL (gallons)	H REMOVAL EFFICIENCY (%)	H MASS REMOVAL RATE (g/day)	AC2EFF (µg/L)	V Δ CONC (µg/L)	V FLOW (gpm)	V FLOW TOTAL (gallons)	V REMOVAL EFFICIENCY (%)	V MASS REMOVAL RATE (g/day)
C	W00	15-Sep-14	Zinc, Dissolved	3500	62.5	3437.5	25.8	259,600	98.2	483.4	148	3352	33.8	340200	95.8	617.6
C	W01	22-Sep-14	Zinc, Dissolved	3800 J	30	3770	30.7	309,600	99.2	630.9	<10	3800	44.5	448200	100	921.8
C	W02	29-Sep-14	Zinc, Dissolved	4000	<10	4000	29.5	297,200	100	643.2	279	3721	41.3	416100	93	837.7
C	W03	06-Oct-14	Zinc, Dissolved	3970	102	3868	30.2	304,500	97.4	636.7	<10	3970	35.1	353800	100	759.6
C	W04	13-Oct-14	Zinc, Dissolved	4000	53	3947	26.8	270,000	98.7	576.6	59.4	3940.6	35.7	359700	98.5	766.8
C	W05	20-Oct-14	Zinc, Dissolved	4160	69.3	4090.7	29.2	294,600	98.3	651.1	65.7	4094.3	35.9	361600	98.4	801.2
C	W06	27-Oct-14	Zinc, Dissolved	4120	47.9	4072.1	27.7	278,800	98.8	614.9	46.9	4073.1	43.2	435500	98.9	959.1
C	W07	03-Nov-14	Zinc, Dissolved	3790	54	3736	28.8	290,300	98.6	586.5	91.7	3698.3	32	322600	97.6	645.1
C	W08	10-Nov-14	Zinc, Dissolved	4230	<10	4230	27.9	280,900	100	643.3	49.4	4180.6	29.8	300300	98.8	679.1
C	W09	17-Nov-14	Zinc, Dissolved	3770	23.5	3746.5	27.9	281,100	99.4	569.8	48.8	3721.2	29.2	294300	98.7	592.3
C	W10	24-Nov-14	Zinc, Dissolved	3760	159	3601	27.0	271,700	95.8	530	54.5	3705.5	29.2	294300	98.6	589.8
C	W11	01-Dec-14	Zinc, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W12	08-Dec-14	Zinc, Dissolved	3900	106	3794	25.5	257200	97.3	527.4	368	3532	27.8	279900	90.6	535.2
C	W13	15-Dec-14	Zinc, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W14	22-Dec-14	Zinc, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C	W15	29-Dec-14	Zinc, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W00	05-Jan-15	Zinc, Dissolved	3470	38.3	3431.7	22.7	228700	98.9	424.6	26.1	3443.9	25.7	259200	99.2	482.5
TR01	W01	12-Jan-15	Zinc, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W02	19-Jan-15	Zinc, Dissolved	3610	42.7	3567.3	20.4	206100	98.8	396.7	25.3	3584.7	25.9	261400	99.3	506.1
TR01	W03	26-Jan-15	Zinc, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W04	02-Feb-15	Zinc, Dissolved	3520	52.9	3467.1	27	272600	98.5	510.3	63.7	3456.3	32	322200	98.2	602.9
TR01	W05	09-Feb-15	Zinc, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W06	16-Feb-15	Zinc, Dissolved	3740	48.5	3691.5	28.6	288400	98.7	575.5	38.4	3701.6	29.3	295600	99	591.2
TR01	W07	23-Feb-15	Zinc, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W08	02-Mar-15	Zinc, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W09	09-Mar-15	Zinc, Dissolved	3290	57.1	3232.9	29.3	295000	98.3	516.3	16.7	3273.3	28.1	283300	99.5	501.4
TR01	W10	16-Mar-15	Zinc, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR01	W11	23-Mar-15	Zinc, Dissolved	4270	52.4	4217.6	34.9	352,200	98.8	802.4	24.2	4245.8	36.4	367300	99.4	842.4
TR01	W12	30-Mar-15	Zinc, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 15. Mass Removal

Horizontal and Vertical Wetland Treatment Trains

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	Analyte Name	FDB (µg/L)	RDEFF (µg/L)	H Δ CONC (µg/L)	H FLOW (gpm)	H FLOW TOTAL (gallons)	H REMOVAL EFFICIENCY (%)	H MASS REMOVAL RATE (g/day)	AC2EFF (µg/L)	V Δ CONC (µg/L)	V FLOW (gpm)	V FLOW TOTAL (gallons)	V REMOVAL EFFICIENCY (%)	V MASS REMOVAL RATE (g/day)
TR02	W00	06-Apr-15	Zinc, Dissolved	3540	44	3496	32.3	325100	98.8	615.5	12.7	3527.3	36	362700	99.6	692.2
TR02	W01	13-Apr-15	Zinc, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W02	20-Apr-15	Zinc, Dissolved	3060	38.2	3021.8	36.7	369,600	98.8	604.5	10.7	3049.3	39.3	395800	99.7	653.2
TR02	W03	27-Apr-15	Zinc, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
TR02	W04	04-May-15	Zinc, Dissolved	3490	62.2	3427.8	35.2	355,100	98.2	658.2	34.7	3455.3	39.1	393700	99	736.4
TR02	W05	11-May-15	Zinc, Dissolved	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NOTES:

Non-detects are reported as <RL and estimated as zero for calculations and graphing.

% = percent

AC1EFF = Aeration Channel Effluent/Rock Drain Influent

AC2EFF = Aeration Cascade Effluent

B = Laboratory flag indicating blank contamination

BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent

C = Colonization

FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)

g/day = grams per day

gpm = gallons per minute

H = horizontal

H Δ CONC = horizontal change in concentration

HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent

J = Laboratory flag indicating estimated value between the MDL and the laboratory RL.

MDL = method detection limit

NS = not sampled

OU = operable unit

ppm = parts per million

RDEFF = Rock Drain Effluent

RL = reporting limit

SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent

SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent

SFWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent

TR** = Test Run

V = vertical

V Δ CONC = vertical change in concentration

VWTT = Vertical Wetland Treatment Train

W** = Week of Treatability Study Phase

The interpolation method for calculating weekly flow totals for both the horizontal and vertical treatment trains was modified to improve precision.

The Aeration Cascade in the VWTT was bypassed on different occasions between 27 OCT 2014 and 16 NOV 2014. The Aeration Cascade Effluent flow rate was used in the weekly flow calculations in monthly reports for the VWTT prior to DEC 2014. The flow rates for the period 27 OCT 2014 - 16 NOV 2014 (and all other weeks) are now calculated based on the Settling Basin No. 2 influent flow rates to better represent metals mass removal by the VWTT.

Table 16. Hydrogen Sulfide Gas (ppm)

Horizontal and Vertical Wetland Treatment Trains

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Phase	Week	Week of	H2S-01 (Aeration Channel Inlet)			H2S-02 (Access Road near Aeration Channel-South)			H2S-03 (Access Road near Aeration Channel-North)			H2S-04 (Access Road near Biotreatment Cell)			H2S-05 (Aeration Cascade Inlet)		
			average	minimum	maximum	average	minimum	maximum	average	minimum	maximum	average	minimum	maximum	average	minimum	maximum
C	W00	15-Sep-14	0.033	0	1.1	0.018	0	1.5	0.0024	0	0.2	0.000	0	0	0.002	0	0.4
C	W01	22-Sep-14	0.016	0	0.7	0.025	0	1	0.0000	0	0	0.000	0	0	0.003	0	0.4
C	W02	29-Sep-14	0.032	0	1.7	0.003	0	0.5	0.0000	0	0	0.007	0	1.1	0.004	0	0.7
C	W03	06-Oct-14	0.022	0	3	0.002	0	0.4	0.0000	0	0	0.004	0	0.7	0.006	0	0.6
C	W04	13-Oct-14	0.005	0	0.5	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
C	W05	20-Oct-14	0.005	0	0.4	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
C	W06	27-Oct-14	0.008	0	0.6	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
C	W07	03-Nov-14	0.000	0	0	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
C	W08	10-Nov-14	0.002	0	0.4	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
C	W09	17-Nov-14	0.000	0	0	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
C	W10	24-Nov-14	0.000	0	0	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
C	W11	01-Dec-14	0.006	0	0.6	0.000	0	0	0.0000	0	0	0.000	0	0	0.002	0	0.4
C	W12	08-Dec-14	0.002	0	0.4	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
C	W13	15-Dec-14	0.008	0	0.7	0.000	0	0	0.0000	0	0	0.000	0	0	0.011	0	0.6
C	W14	22-Dec-14	0.000	0	0	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
C	W15	29-Dec-14	0.000	0	0	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
TR01	W00	05-Jan-15	0.002	0	0.4	0.000	0	0	0.0000	0	0	0.000	0	0	0.005	0	0.4
TR01	W01	12-Jan-15	0.007	0	0.7	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
TR01	W02	19-Jan-15	0.002	0	0.4	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
TR01	W03	26-Jan-15	0.002	0	0.4	0.000	0	0	0.0000	0	0	0.000	0	0	0.002	0	0.4
TR01	W04	02-Feb-15	0.000	0	0	0.000	0	0	0.0000	0	0	0.000	0	0	0.002	0	0.4
TR01	W05	09-Feb-15	0.002	0	0.4	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
TR01	W06	16-Feb-15	0.013	0	0.6	0.000	0	0	NA ¹	NA ¹	NA ¹	0.000	0	0	0.030	0	5
TR01	W07	23-Feb-15	0.033	0	0.8	0.000	0	0	NA ¹	NA ¹	NA ¹	0.000	0	0	0.012	0	0.4
TR01	W08	02-Mar-15	0.005	0	0.5	0.000	0	0	NA ¹	NA ¹	NA ¹	0.000	0	0	0.005	0	0.4
TR01	W09	09-Mar-15	0.000	0	0	0.000	0	0	NA ¹	NA ¹	NA ¹	0.000	0	0	0.000	0	0
TR01	W10	16-Mar-15	0.000	0	0	0.000	0	0	NA ¹	NA ¹	NA ¹	0.000	0	0	0.000	0	0
TR01	W11	23-Mar-15	0.002	0	0.4	0.000	0	0	NA ¹	NA ¹	NA ¹	0.000	0	0	0.000	0	0
TR01	W10	16-Mar-15	0.000	0	0	0.000	0	0	NA ¹	NA ¹	NA ¹	0.000	0	0	0.000	0	0
TR01	W11	23-Mar-15	0.002	0	0.4	0.000	0	0	NA ¹	NA ¹	NA ¹	0.000	0	0	0.000	0	0
TR01	W12	30-Mar-15	0.002	0	0.4	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
TR02	W00	06-Apr-15	0.000	0	0	0.000	0	0	0.0000	0	0	0.000	0	0	0.005	0	0.9
TR02	W01	13-Apr-15	0.002	0	0.4	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
TR02	W02	20-Apr-15	0.000	0	0	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
TR02	W03	27-Apr-15	0.002	0	0.4	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
TR02	W04	04-May-15	0.000	0	0	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
TR02	W05	11-May-15	0.007	0	0.6	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0
TR02	W06	18-May-15	0.000	0	0	0.000	0	0	0.0000	0	0	0.000	0	0	0.000	0	0

NOTES:¹H2S-03 Sensor was removed due to failure during calibration on 19 FEB 2015. It was reinstalled on 27 MAR 2015 after repairs were completed.

AC1EFF = Aeration Channel Effluent/Rock Drain Influent

AC2EFF = Aeration Cascade Effluent

BTEFF = Biotreatment Cell Effluent/Aeration Cascade Influent

C = Colonization

FDB = Flow Diversion Box (Settling Basin No. 1 Influent/Settling Basin No. 2 Influent)

gpm = gallons per minute

HSSFWMP11 = Horizontal Sub Surface Flow Wetland Effluent/Aeration Channel Influent

NA = Not available

OU = operable unit

ppm = parts per million

RDEFF = Rock Drain Effluent

SB1EFF = Settling Basin No. 1 Effluent/Surface Flow Wetland Influent

SB2EFF = Settling Basin No. 2 Effluent/Biotreatment Cell Influent

SWEFF = Surface Flow Wetland Effluent/Horizontal Sub Surface Flow Wetland Influent

TR** = Test Run

W** = Week of Treatability Study Phase

Horizontal Wetland Treatment Train Summary

MAY 2015

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

HSSF Wetland Train Report for May 2015

(Analytical data from May, 2015)

Overall Performance

The HSSF wetland continues to remove cadmium and zinc very well, but has removed manganese poorly during this reporting cycle. Other water quality parameters are excellent.

Flow rates into the HWTT were set at 37-38 gpm on March 24-26, but they have been decreasing steadily since late April (Figure 1). The reasons for this steady decline are not clear, although there have been a number of adjustments made to discharge levels that likely affected flow rates.

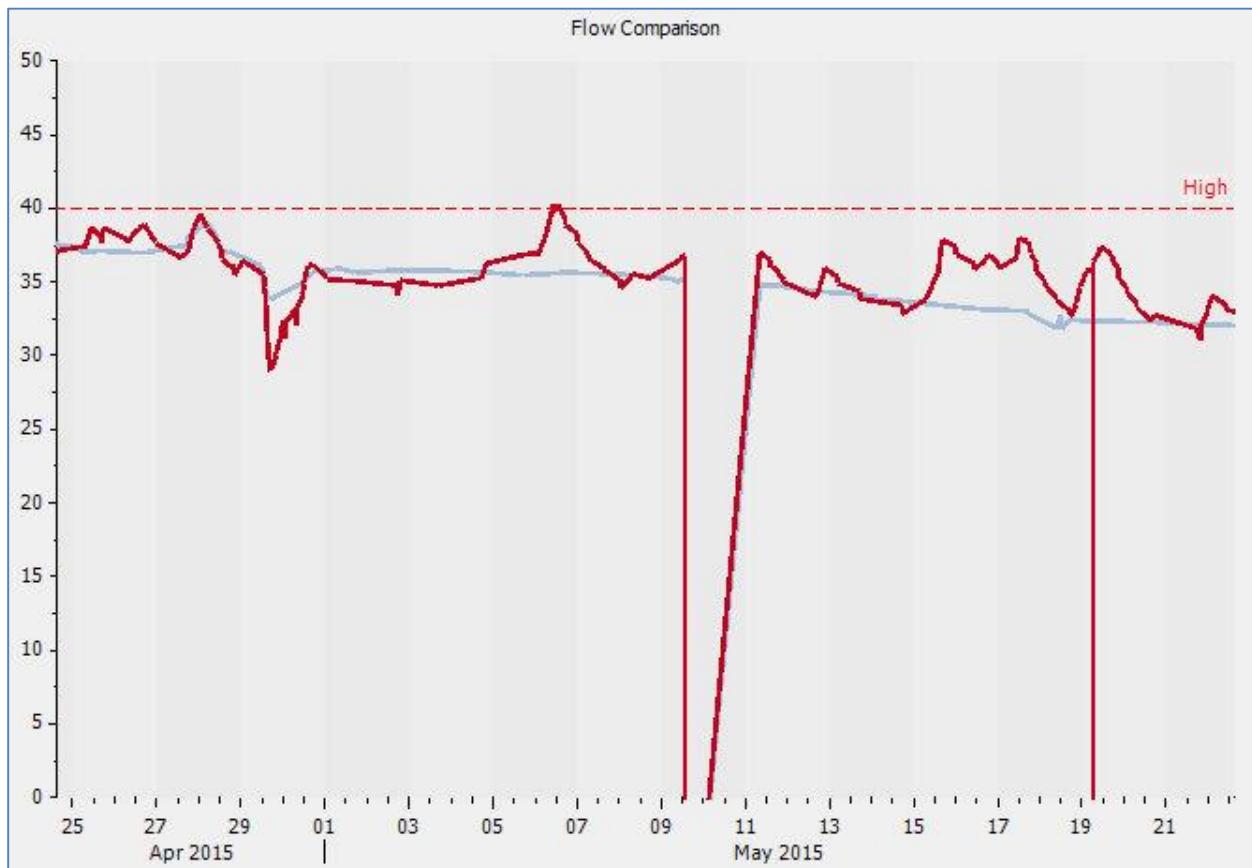


Figure 1. Flows into HWTT in May 2015.

Air temperature at the site has been increasing, at times reaching or exceeding water temperature during daytime hours. As a consequence, heat loss has decreased as water flows through the system compared with winter months (Figure 2). Water temperature only decreases by 1-2 °C from feed to HSSF wetland outlet and a further 2 °C to the rock drain (RD) effluent.

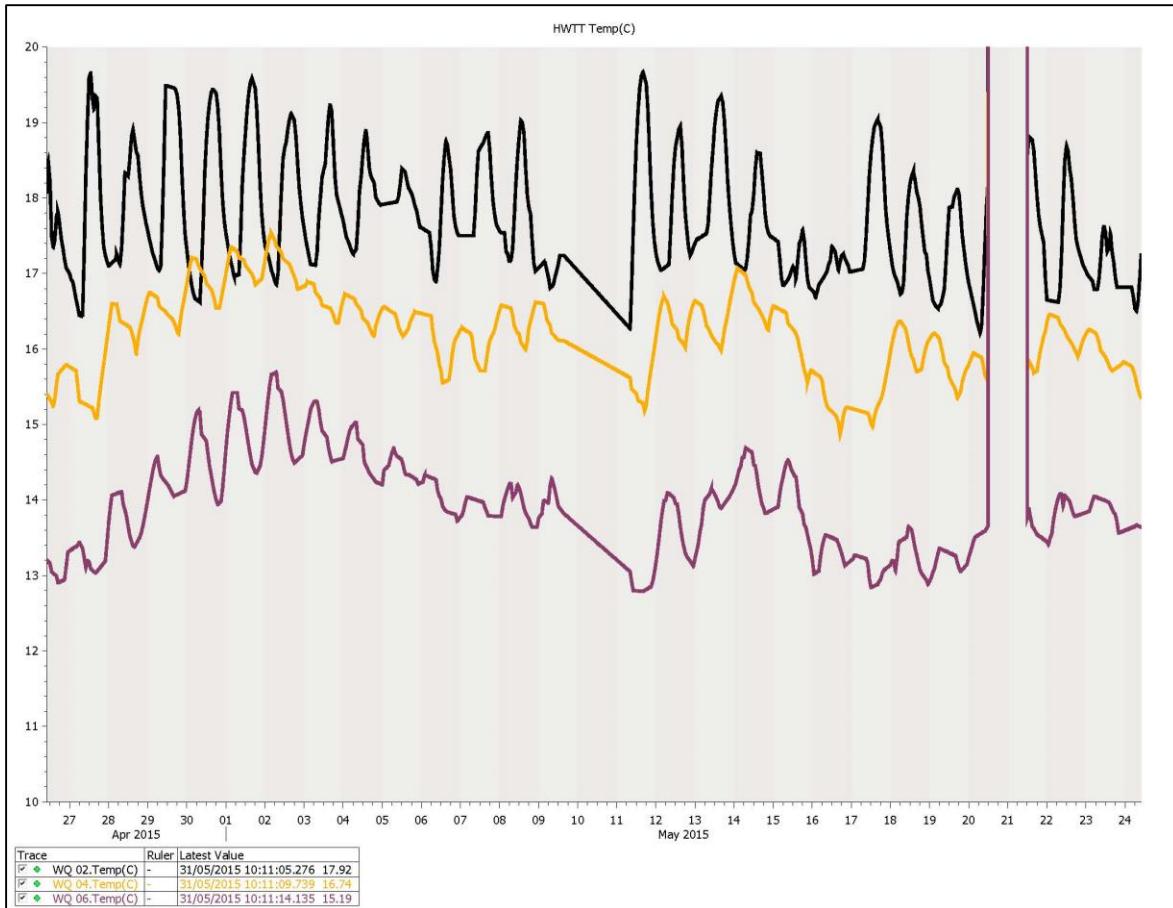


Figure 2. Changes in water temperature from January to March 2015.

Legend: black line is Inlet, orange line is HSSF wetland effluent, and purple line is rock drain effluent.

Water pH has remained between 6.5 and 6.8 since the beginning of the year, but this began to change in the last week of May (Figure 3). Mine water pH (feed) has varied between 6.5-6.6 in April and early May, and then dramatically decreased on May 18 to 5.9. The HSSF wetland effluent pH has mirrored this trend, whereas the rock drain effluent has been unaffected.

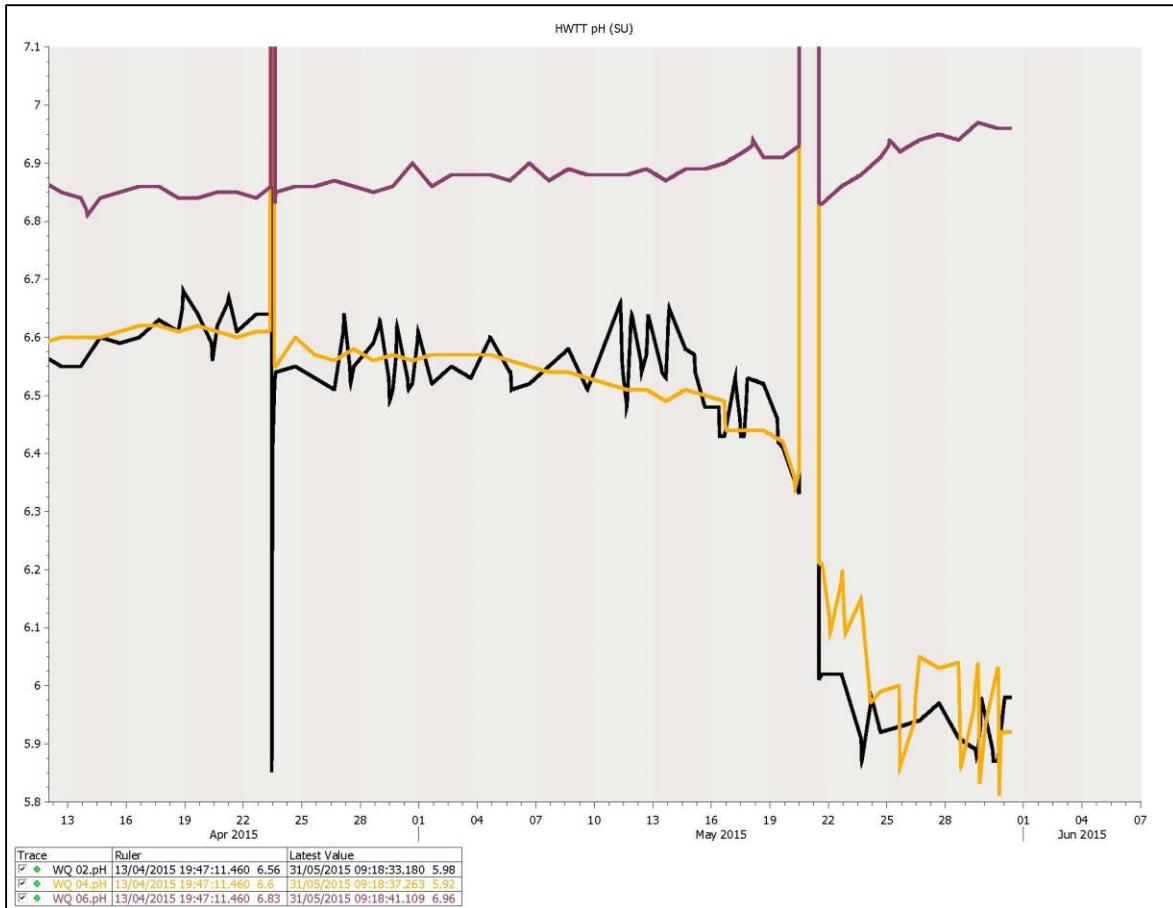


Figure 3. Changes in water pH in April and May 2015.

Legend: black line is Inlet, orange line is HSSF wetland effluent, and purple line is rock drain effluent.

The ORP for the HSSF wetland effluent has remained in the optimal range of -325 to -375 mV through May, until the last week when it began to rise dramatically (Figure 4). This trend mirrors the changes in water pH, suggests that the latter are responsible for the changes in effluent ORP. Unfortunately, we cannot determine the effect of these changes on metal removal because the last sample for laboratory analysis was collected on May 18, one day before the abovementioned changes.

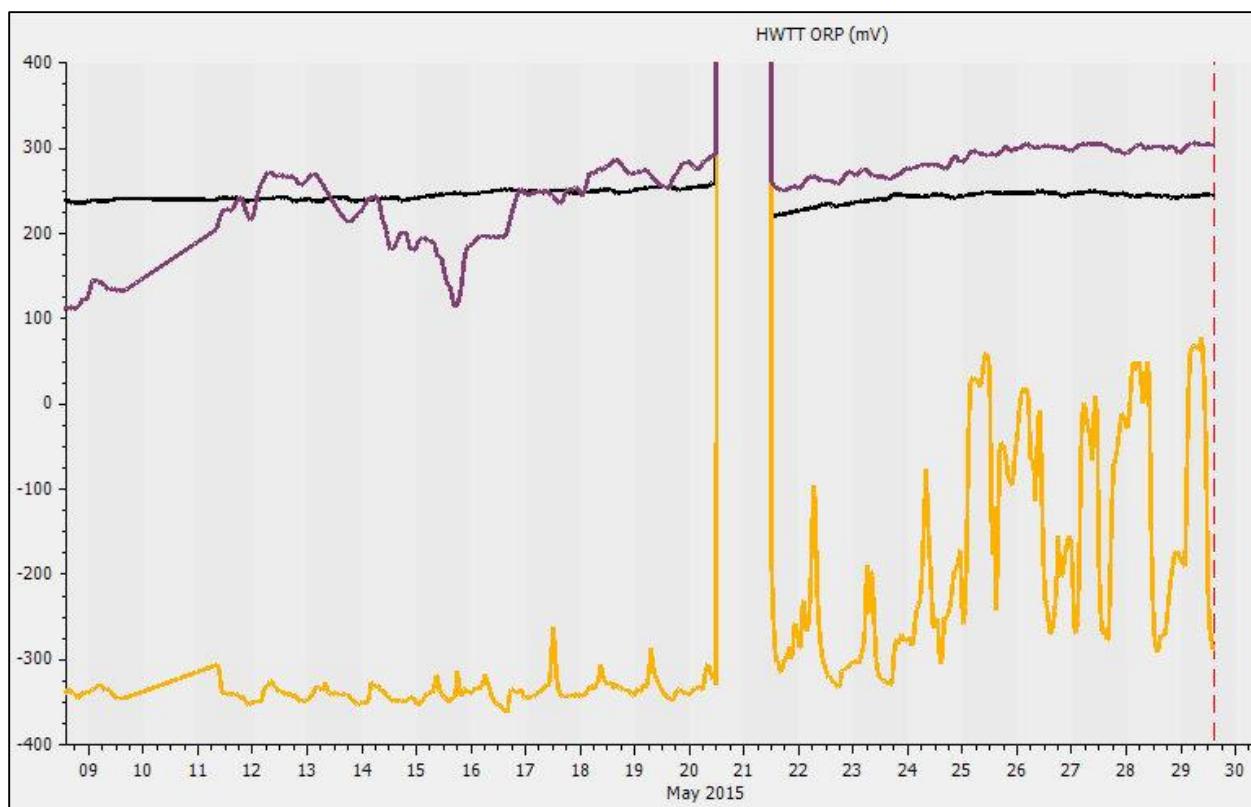


Figure 4. Changes in water ORP in May 2015.
Legend: black line is Inlet, orange line is HSSF wetland effluent, and purple line is rock drain effluent.

Flow Diversion Box/Feed Chemistry

Feed chemistry has remained constant during this sampling period Table 1. No sample was collected after May 19, when feed pH started to decrease. It will be important to determine if the change in this parameter is accompanied with significant changes in other water quality parameters.

Table 1. Levels of key constituents in feed.

Constituent	April 20	May 4
Alkalinity	120	108
Aluminum	659	795
Arsenic	1.5	1.3
Cadmium	18	20.1
Copper	141	148
Iron	9,020	8,630
Lead	20.5	20
Manganese	1,880	1,880
Sulfate	616	660
TSS	17	27
Zinc	3,260	3,655

Every parameter/metal is for Total, not Dissolved.

Units in µg/L, except for alkalinity, sulfate and TSS (mg/L).

Settling Basin

Settling Basin No. 1 is performing consistently well, as turbidity levels largely fluctuated between 5-20 NTU in May (Figure 5). The increased flow rates introduced on March 24-25 have not caused any loss of performance. In addition, the decrease in feed pH has not affected SB1 effluent turbidity.

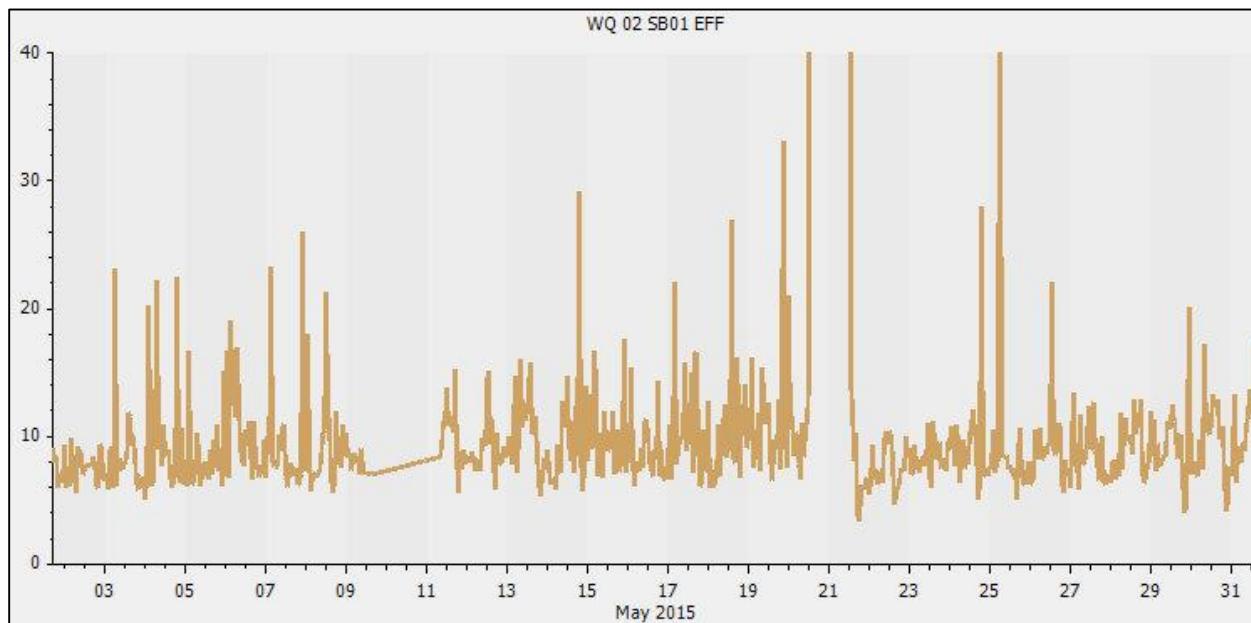


Figure 5. Turbidity measurements in SB1 effluent in May 2015.

Total suspended solids (TSS) decreased from an average of 22 mg/L in the SB1 influent to < 10 mg/L in its effluent. Total Iron concentrations decreased from an average of 8.8 mg/L to 3.3 mg/L in the SB effluent.

SF Wetland

Water quality parameters remained largely unchanged in the SF Wetland in May, except for Dissolved Iron in the May 4 sample, which came in at 0.29 mg/L and was discharged at 1.4 mg/L. Additionally, Dissolved Aluminum concentrations increased in that sample from 0.17 mg/L to 1.1 mg/L. These results may or may not be outliers and will be investigated further.

HSSF Wetland

The changes in effluent pH and ORP noted above occurred after May 19, but samples analyzed for metals were collected earlier, so it is not possible to determine the effect of these changes on metal removal.

In the April 20 and May 4 samples, both cadmium and zinc were removed very effectively. Cadmium concentrations decreased in the HSSF wetland from average influent concentrations of 21.8 µg/L to effluent concentrations of 1.05 µg/L, while zinc levels decreased from influent concentrations of 3,888 µg/L to effluent concentrations of 600 µg/L. As before, effluent concentrations for the dissolved analytes were exceedingly low, with zinc levels reaching 50 µg/L.

Dissolved and Total iron levels decrease to approximately 150 µg/L in the wetland effluent. Other metals, including aluminum, copper, lead and nickel, are completely removed.

As noted before, manganese concentrations decreased in the HSSFW by approximately 50%, from average influent concentrations of 1,988 µg/L to average effluent concentration of 963 µg/L.

Biological Oxygen Demand (BOD) in the HSSFW effluent was low, averaging < 2 mg/L.

Aeration Channel

The performance of the aeration channel has not changed. Sulfide removal has been consistent in this reporting period, with average influent concentrations of 2.0 mg/L decreasing to 1.2 mg/L. Dissolved iron levels were unusually high in channel effluent in the April 20 sample (1,100 µg/L), but returned to the more usual 115 µg/L effluent concentration in the May 4 sample.

Rock Drain

Manganese removal was poor again in this reporting period. A plan of investigation has been developed to determine the causes of this poor performance, but it has not yet been implemented.

Conclusions – HSSF Treatment Train

The HSSF treatment train performance has been mixed in this reporting period. Cadmium and zinc continue to be removed very well, but manganese removal has faltered. Other metals are also removed effectively, despite gradually increasing concentrations.

The effects of decreased pH in feed will not be determined until the next field sampling and will be reported in the next monthly report.

Vertical Wetland Treatment Train Summary

MAY 2015

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

Rico Vertical Wetland Treatment Train Report for May 2015

Results from two VWTT sampling events that occurred on April 23, 2015 and May 6, 2015 have been received since submittal of the April 2015 monthly report. Results from these two sampling events are discussed below. The VWTT flow rate ranged from approximately 35 gpm to 40 gpm during the reporting period.

Settling Basin No. 2

Settling Basin No. 2 performance was similar to previously reported results. Settling Basin No. 2 performance remains lower than prior to the VWTT flow increase on March 25. Turbidity decreased from an average influent level of 28 NTU to an average effluent level of 10 NTU.

Total arsenic, copper, iron and lead concentrations decreased, with respective average removal efficiencies of 100%, 71%, 70% and 75%. Insignificant removal was observed for cadmium, manganese, nickel and zinc. Total aluminum concentrations increased by 30%, presumably due to the presence of residual aluminum chlorohydrate coagulant. TSS concentrations decreased from an average influent concentration of 22 mg/L to an average effluent concentration of 9 mg/L.

Biotreatment Cell

Total aluminum concentrations decreased from an average influent concentration of 953 µg/L to below laboratory detection limits. Total copper concentrations decreased from an average influent concentration of 42.6 µg/L to below laboratory detection limits. Total iron concentrations decreased from an average influent concentration of 2,680 µg/L to an average effluent concentration of 263 µg/L. Total lead concentrations decreased from an average influent concentration of 5.1 µg/L to below laboratory detection limits. Total cadmium concentrations decreased from an average influent concentration of 17.0 µg/L to below laboratory detection limits. Total zinc concentrations decreased from an average influent concentration of 3,135 µg/L to an average effluent concentration of 182 µg/L. Total manganese concentrations decreased from an average influent concentration of 1,865 µg/L to an average effluent concentration of 763 µg/L. Influent and effluent total arsenic results were below laboratory detection limits.

Dissolved aluminum concentrations decreased from an average influent concentration of 564 µg/L to below laboratory detection limits. Dissolved cadmium concentrations decreased from an average influent concentration of 17.0 µg/L to below laboratory detection limits. Dissolved zinc concentrations decreased from an average influent concentration of 3,015 µg/L to an average effluent concentration of 17.9 µg/L. Dissolved manganese concentrations decreased

from an average influent concentration of 1,850 µg/L to an average effluent concentration of 767 µg/L.

Average effluent BOD, TOC and total sulfide concentrations were 2.6 mg/L, 1.4 mg/L and 3.9 mg/L, respectively. Total alkalinity increased from an average influent concentration of 111 mg/L to an average effluent concentration of 124 mg/L.

Aeration Cascade

Total and dissolved concentrations of all metals were slightly below but not significantly different from the average influent concentrations. Average effluent BOD, TOC and total sulfide concentrations were non-detect, 1.2 mg/L and 1.25 mg/L, respectively.

Conclusions and Observations – Vertical Wetland Treatment Train

VWTT metals removal performance was within design expectations at design flow rates. The VWTT is currently achieving water quality effluent targets from the 2008 WQA for all metals with a significant safety margin. The Colorado State Reg 34 criteria of 255 µg/L for manganese is not being achieved, but this was not a design goal of the VWTT.

Concentrations of dissolved iron and dissolved aluminum in effluent from Settling Basin No. 2 increased by approximately one order of magnitude compared to previous results. Similar increases were not observed in Settling Basin No. 1 in the HWTT despite nearly identical influent water chemistry and a shorter hydraulic residence time in Settling Basin No. 1. The cause of this change is currently being investigated.

Wetland Plant Update

MAY 2015

St. Louis Tunnel Discharge Constructed Wetland Demonstration Treatability Study

Rico-Argentine Mine Site – Rico Tunnels, Operable Unit OU01

RICO WETLAND DEMONSTRATION PROJECT - SF and HSSF WETLAND CELLS

May 12th, 2015 Monitoring



Photograph 1: SF Wetland with Planted Bulrush, Sedge and Rush – Looking South on May 12th, 2015



Photograph 2: SF Wetland with Planted Bulrush, Sedge, and Rush – Looking West on May 12th, 2015

RICO WETLAND DEMONSTRATION PROJECT - SF and HSSF WETLAND CELLS

May 12th, 2015 Monitoring



Photograph 3: SF Wetland with Planted Sedge Looking Southeast on May 12th, 2015



Photograph 4: SF Wetland with Planted Sedge Looking East on May 12th, 2015

RICO WETLAND DEMONSTRATION PROJECT - SF and HSSF WETLAND CELLS

May 12th, 2015 Monitoring



Photograph 5: SF Wetland with Planted Bulrush and Sedge Looking Northeast on May 12th, 2015



Photograph 6: SF Wetland with Planted Bulrush and Sedge Looking East on May 12th, 2015

RICO WETLAND DEMONSTRATION PROJECT - SF and HSSF WETLAND CELLS

May 12th, 2015 Monitoring



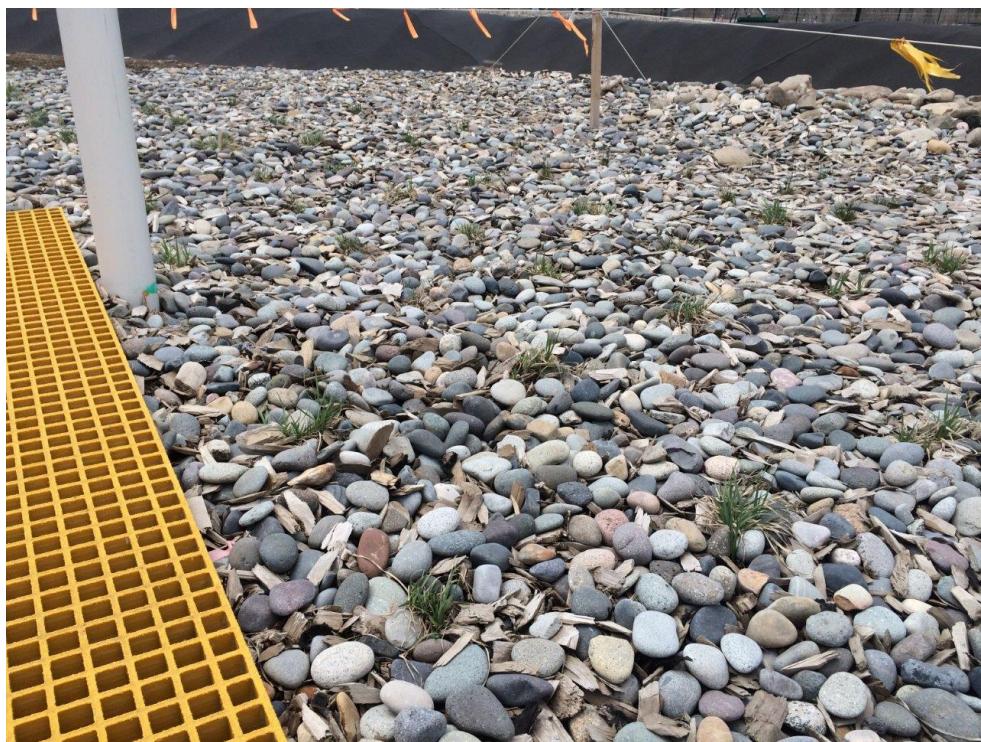
Photograph 7: HSSF Wetland with Establishing Wetland Plants – Looking South on May 12th, 2015



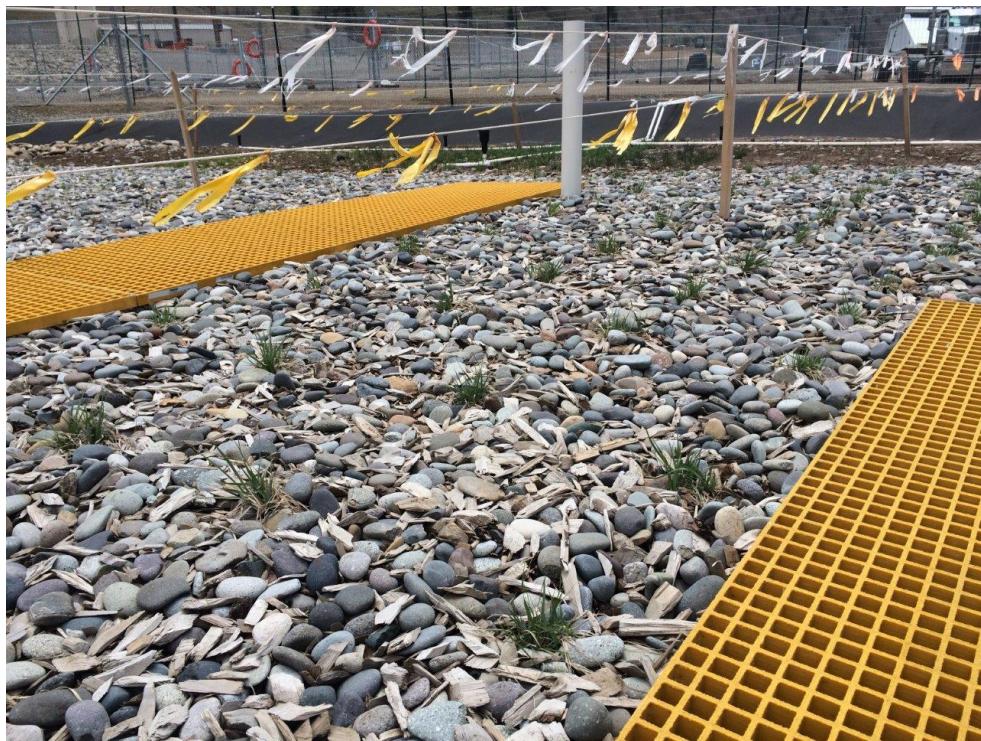
Photograph 8: HSSF Wetland –Sampling Points Comparing Planted Vegetation
On either side of Southwestern FRP on May 12th, 2015

RICO WETLAND DEMONSTRATION PROJECT - SF and HSSF WETLAND CELLS

May 12th, 2015 Monitoring



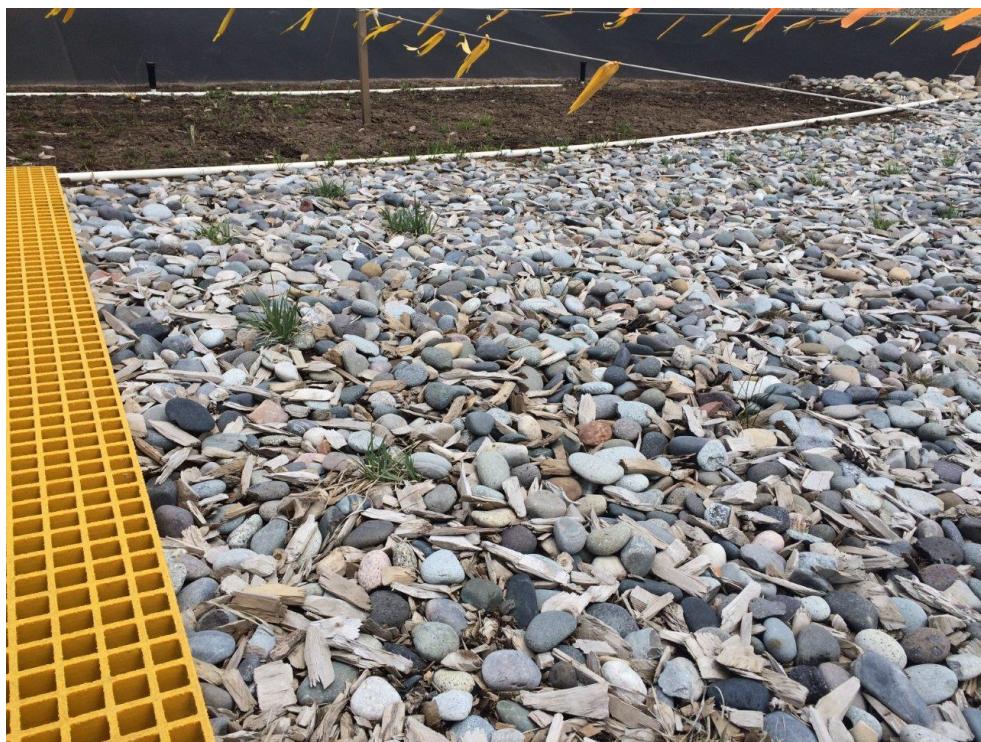
Photograph 9: HSSF Wetland –Sampling Points Comparing Planted Vegetation
On either side of Southwestern FRP on May 12th, 2015



Photograph 10: HSSF Wetland - Sampling Point Comparing Planted Vegetation
On either side of Southwestern FRP on May 12th, 2015

RICO WETLAND DEMONSTRATION PROJECT - SF and HSSF WETLAND CELLS

May 12th, 2015 Monitoring



Photograph 11: HSSF Wetland – Sampling Point in Matrix –
Located East of North E of Middle FRP on May 12th, 2015



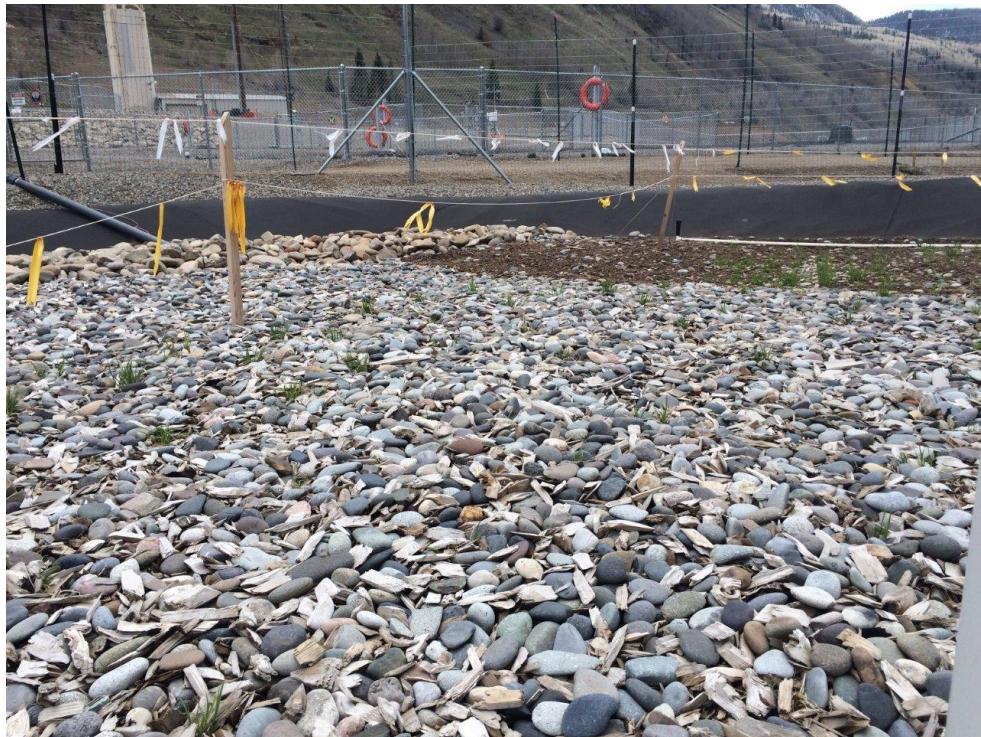
Photograph 12: HSSF Wetland – Sampling Point in Northern Soil Test Strip
Reviewing Planted Wetland Vegetation Success on May 12th, 2015

RICO WETLAND DEMONSTRATION PROJECT - SF and HSSF WETLAND CELLS

May 12th, 2015 Monitoring



Photograph 13: HSSF Wetland – Close-up Photo of Planted Sedge and a Volunteer Species
Showing New Growth on May 12th, 2015



Photograph 14: HSSF Wetland – Sampling Point Located in Southeast Quadrant
East of Southeast FRP on May 12th, 2015

RICO WETLAND DEMONSTRATION PROJECT - SF and HSSF WETLAND CELLS

May 12th, 2015 Monitoring

HSSE Wetland Plant - Monitoring Plot Locations

